

# The Current Situation and Diagnostic Approach of Nagana in Africa: A review

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## SUMMARY

Animal African Trypanosomosis (AAT) or Nagana occurs in 37 sub-Saharan countries covering more than 9 million km<sup>2</sup>, an area which corresponds approximately to one-third of the Africa's total land area. African animal Trypanosomosis continues to be the major constraint of livestock production in sub-Saharan Africa including Ethiopia. It is caused by protozoan parasites that belong to the genus Trypanosome. The main species of trypanosomes affecting livestock are *Trypanosome congolense*, *T.vivax* and those in the *T.brucei* group. Among others, tsetse flies play a major role in the transmission of Trypanosomes. They disease cause loss of animal productivity and mortality in severely infected animal if left untreated. The Nagana has a severe impact on agriculture economic losses in cattle production alone are in the range of US\$ 1.0 -1.2 billion. A ponderated evaluation extrapolated for the total tsetse-infested lands values total losses, in terms of agricultural Gross Domestic Product, at US\$ 4.75 billion per year. The clinical signs of African animal trypanosomosis are not pathognomonic. Therefore; confirmatory diagnosis of this disease is based on clinical diagnosis, parasitological methods, serological test, animal inoculation and molecular tests. However, there are several advantages and disadvantages in relation with the tests. Furthermore, some of the tests are not applicable to the field. Moreover, the presence of antibody in the serum does not necessarily reflect an existing infection, as antibodies' may persist for several months following recovery. Diagnosis of trypanosomosis should be based on clinical signs and following by laboratory conformation tests. In this manuscript the African animal trypanosomosis and its diagnostic approach is reviewed.

Key words: African animal trypanosomosis, Cattle, Diagnosis, Nagana

## 1. INTRODUCTION

African animal trypanosomosis (AAT) is a disease complex caused by tsetse-fly transmitted *Trypanosoma congolense*, *T.vivax* and *T. brucei brucei*, or simultaneous infection with one or more of these trypanosomes. Infection of cattle by one or more of the three African animal trypanosomes results in sub-acute, acute or chronic disease characterized by intermittent fever, anemia, occasional diarrhea and rapid loss of condition and often terminates in death (Mare, 2004). As the illness progresses the animals weaken more and more and eventually become unfit for work, hence the name of the disease "Nagana" which is a Zulu word that means "powerless/useless" (Winkle *et al.*, 2005). Because of Nagana, stock farming is very difficult within the tsetse belt (WHO, 2006).

African animal trypanosomosis and its vectors occur in areas of the Sub-Saharan African (SSA) with devastating impact on livestock productivity posing a serious threat to the lives and communities. Of the 165 million cattle found in Africa, only 10 million are found within the tsetse fly free belt, and these are mostly low producing breeds which are maintained on high drug management regimes to keep trypanosomosis at bay (Jones and Davila, 2001). It constitutes the greatest single constraint to livestock and crop production by directly contributing to hunger, poverty, malnutrition and suffering of entire communities in Africa (Pattec, 2002). The disease has also economic importance due to loss of condition, reduction in milk yield, decrease capacity of work (Reghu *et al.*, 2008).

Tsetse flies in Ethiopia are confined to southwestern and northwestern regions between longitude 33° and 38° E and latitude 5° and 12° N covers an area of 220,000km<sup>2</sup> (NTTICC, 2004). Around 14 million head of cattle, an equivalent number of small ruminants, nearly 7 million equines and 1.8 million camels are at the risk of contracting trypanosomosis at any one time (MoARD, 2004). Six species of trypanosome are recorded in Ethiopia and the most important trypanosomes, in terms of economics loss in domestic livestock, are the tsetse transmitted species: *T.congolense*, *T.vivax* and *T. brucei* group (Abebe, 2005).

Accurate diagnosis of trypanosome infections in livestock is required for a proper appreciation of the epidemiology of the disease. However, high parasitaemia are usually evident only in early infections, and in the chronic phase of the disease, parasites may apparently be absent from the blood for long intervals. This is due to the ability of trypanosomes to establish prolonged infections attributed to the phenomenon of antigenic variation.

As parasitaemia rises, a swift antibody response is elicited against the antigen types exposed on the surface of the bloodstream trypanosome (Coetzer *et al.*, 1994). Therefore diagnostic methods with high degree of sensitivity and specificity are required. Besides clinical diagnosis, direct (parasitological) and indirect (serological) diagnostic methods with varying degree of sensitivity and specificity are available. Therefore, the objectives of this manuscript are to provide a highlight on the current situation of Nagana in African and to compile existing information on the general diagnostic approaches.

## 2. AFRICAN CATTLE TRYPANOSOMOSIS (NAGANA)

### 2.1 Etiology

Trypanosomes are protozoan parasites in the family Trypanosomatidae. Most trypanosomes are transmitted by tsetse flies. Except, the two tsetse-transmitted parasites, *T.brucei gambiense* and *T.brucei rhodesiense*, those cause human African trypanosomiasis/sleeping sickness, which affects both humans and animals (OIE, 2009). The remaining tsetse-transmitted trypanosomes primarily affect animals and cause African animal trypanosomosis. The most important species in this disease are *Trypanosoma congolense*, *T.vivax* and *T.brucei subspecies brucei*. Other species such as *T.simiae* and *T.godfreyi* can also cause AAT. Some trypanosome infections in Africa cannot be identified as any currently recognized species. Concurrent infections can occur with more than one species of trypanosome (OIE, 2008). *Trypanosoma congolense*, *T. vivax* and *T.brucei* have been reported to cause Nagana in cattle (Mbaya *et al.*, 2010). In Ethiopia, the most important trypanosomes, in terms of economic loss in domestic livestock, are the tsetse transmitted species: *T.congolens*, *T.vivax* and *T.brucei* (Abebe, 2005).

### 2.2 Geographical Distribution and Host Range

African Trypanosomes can be found wherever the tsetse fly vector exists. *Trypanosomes vivax* can spread beyond the “tsetse fly belt” by transmission through mechanical vectors. Tsetse transmitted African trypanosomosis is found between latitude 15°N and 29°S covering across over 37 countries in Africa, from the southern edge of the Sahara desert to Zimbabwe, Angola and Mozambique (OIE, 2009). It is the most economically important livestock disease of Africa, especially of cattle (WOAH, 2012).

All species of domestic animals are susceptible to infection especial cattle with one or more species of trypanosomes, and with 14 million heads at risk in Ethiopia (NTTICC, 1996). However, in addition to infection of domesticated livestock, trypanosomes are found in many species of wild mammals. Trypanosomes infections are economically important in cattle, considering its major role in the agricultural economy of Ethiopia (Abebe, 2005).

### 2.3 Pathogenesis

Initial replication of trypanosomes is at the site of inoculation in the skin; this causes a swelling and a sore (chancre). Trypanosomes then spread to the lymph nodes and blood and continue to replicate. *Trypanosoma congolense* localizes in the endothelial cells of small blood vessels and capillaries. *Trypanosoma b.brucei* and *T.vivax* localize in tissue. Antibody developed to the glycoprotein coat of the trypanosome kills the trypanosome and results in the development of immune complexes (OIE, 2008).

Antibody, however, does not clear the infection, for the trypanosome has genes that can code for many different surface-coat glycoproteins and change its surface glycoprotein to evade the antibody. Thus, there is a persistent infection that results in a continuing cycle of trypanosome replication, antibody production, immune complex development, and changing surface-coat glycoproteins. Immunologic lesions are significant in trypanosomosis, and it has been suggested that many of the lesions (e.g., anemia and glomerulo-nephritis) in these diseases may be the result of the deposition of immune complexes that interfere with, or prevent, normal organ function. The most significant and complicating factor in the pathogenesis of trypanosomosis is the profound immune-suppression that occurs following infection by these parasites. This marked immune-suppression lowers the host's resistance to other infections and thus results in secondary disease, which greatly complicates both the clinical and pathological features of trypanosomosis (Mare, 2004).

## 3. DIAGNOSTIC APPROACHES FOR NAGANA

Diagnosis of trypanosomosis humans and domestic livestock as well as in tsetse fly is a basic requirement for epidemiological studies as well as for planning and implementing chemotherapy and for monitoring vector control operations. Accurate diagnosis of trypanosome infection in livestock is required for a proper appreciation of the epidemiology of the disease in any geographical locality. Besides clinical diagnosis, direct (parasitological), indirect (serological), animal inoculation and molecular diagnostic methods with varying degrees of sensitivity and specificity are available for trypanosomosis (IAEA, 2007).

### 3.1 Clinical Diagnosis

Trypanosomosis should be a consideration in endemic areas when an animal is anemic and in poor condition (OIE, 2009). Nagana is classically acute or chronic and is affected by poor nutrition, concurrent diseases and other stressors. Particularly, in cattle it is usually chronic some may slowly recover but usually relapse when stressed. The major clinical signs are: intermittent fever, anemia, oedema, lacrimation, enlarged lymph nodes, abortion and decreased fertility, loss of appetite, body condition and productivity, early death in acute forms, emaciation and eventual death in chronic forms often after digestive and/or nervous signs. When tsetse challenge is high, morbidity is usually also high. All three species of trypanosomes are eventually cause death in their hosts unless treated (WOAH, 2012)

### 3.2 Parasitological Diagnosis

#### 3.2.1 Wet blood films

Through this parasitological diagnosis method the actively motile organisms of trypomastigote stage of the trypanosome are readily detected by the agitation they produce among the erythrocytes (Paris *et al.*, 1982). This method of diagnosis is simple, inexpensive and gives an immediate result, which is if trypanosomes are found, the disease is diagnosed on the spot (OIE, 2008). Although, wet blood film parasitological diagnosis method has the above mentioned advantages there are different drawbacks of this method and which includes: Unless the animal are brought to the veterinary center or the blood (with an anticoagulant) can be taken quickly to the center, a field microscope has to be take to the herd, as the parasite loses their mobility after a limited time. It has also limited sensitivity and the species of trypanosome cannot be identified. (*T.vivax* can often be strongly suspected if the parasites move quickly forward thought the microscopically filed). The diagnostic sensitivity of the method is generally depends on the examiner's experience and the level of parasitaemia (OIE, 2008).

#### 3.2.2 Fresh preparation of Lymph

Trypanosomes, particularly *T.vivax*, are sometimes found in lymph collected from a lymph node. When they are not found in blood the lymph are usually collected from swollen prescapular lymph nodes. And it is examined like blood. The presences of trypanosomes are usually only seen indirectly, by the movements of the lymphocytes, because the great density of the lymphocytes will obscure the trypanosomes (Taylor *et al.*, 2007).

#### 3.2.3 Thick blood film

These are made by placing a drop of blood (5–10 $\mu$ l) on a clean microscope slide and the thickness of the resultant film should be such that, when dry, the figures on a wristwatch dial can just be read through it (IAEA, 2007). The dry smear should be kept dry and protected from dust, heat, flies and other insects. It is stained for 30 minutes with 4% diluted Giemsa stain in phosphate buffered saline, pH 7.2. Staining time and stain dilution may vary with stain and individual technique (OIE, 2013). Thick blood film diagnosis method is simple and inexpensive, the trypanosomes are easily recognized by their general morphology and field microscope is not needed as the blood films are taken back to the center for processing and examination at ease. It is sometimes (but mostly not) possible to indentify the trypanosomes species seen. However, the shortcoming of this technique is that an immediate diagnosis of trypanosomes on the spot is not possible and the sensitivity of the method remains limited (Uilenberg, 1998 and OIE, 2013).

#### 3.2.4 Thin blood smear

These are made as in the case of blood smears to detect on the blood parasites like trypanosomes. They are fixed by methanol and stained with Giemsa stain, or with one of the more recent test stains such as Diff-Quik, field's stain, which have the advantage of acting much faster than Giemsa. They are read using oil immersion objectives, for identification of trypanosomes (Murray *et al.*, 2003). Hence, what is most important thing of using such a method is that specific diagnosis of trypanosomes is possible. Nevertheless, the sensitivity is extremely low, and the main use of thin smear is in fact the specific identification of trypanosomes found in wet or thick smears (Uilenberg, 1998 and OIE, 2013).

#### 3.2.5 Thin smears of lymph

Lymph aspirated from a prescapular lymph node, instead of being examined as a fresh preparation (after afresh preparation has been positive), Can also be made in to a thin smear fixed and stained, which will make specific identification possible. The smears should be very thin, as the many lymphocytes, which are also stained, complicate the visualization of the parasites. For this reason thick lymph smears are not suitable for diagnosis, lymphocytes cannot be lysed as can red blood cells (Taylor *et al.*, 2007).

### 3.3 Serological Tests

Several antibody detection techniques have been developed to detect specific trypanosomal antibodies for the diagnosis of animal trypanosomosis, with variable sensitivity and specificity (Bengaly *et al*, 2002). The aim of serological tests is to detect specific antibodies (which are blood proteins belonging to the immunoglobulin's), developed by the host against the infection or inversely, to demonstrate the occurrence of circulating parasitic antigens in the blood by the use of characterized specific antibodies. The detection of antibodies indicates that as there has been infection, but as antibodies persist for some times (weeks, sometimes months) after all trypanosomes have disappeared from the organism (either by drug treatment or self-cure) a positive result is no proof active of infection. On other hand, circulating trypanosomal antigens are eliminated quickly after the disappearance of the trypanosomes and their presences therefore shows almost always that live trypanosomes are present in the animal (Uilenberg, 1998).

Two serological tests, the indirect fluorescent antibody tests and enzyme-linked immunosorbent assays (ELISA), are routinely used to identify seropositive cattle. Because reactions to previous infections can be detected, serology is useful only for a presumptive diagnosis. Cross-reactions can occur with other trypanosomes such as *T.theileri*, which is not pathogenic, and *T.evansi*, which causes Surra (OIE, 2009).

### 3.4 Animal Inoculation

Animal inoculation studies in rats or mice may occasionally be used to diagnose AAT. This technique is very sensitive and can detect low levels of parasites, but it is also time consuming (OIE, 2009). The sensitivity of this method varies according to the species or even strain present and the susceptibility of the experimental animals used as shown in table 1 below (OIE, 2008). The laboratory animals are injected intraperitoneally with 0.1–0.5ml (depending on the size of the rodent) of freshly collected blood. Artificial immune suppression of recipient animals by irradiation or drug treatment (cyclophosphamide 200 mg/kg) will greatly increase the chances of isolating the parasite. A drop of blood is collected from the tip of the rodent's tail three times a week. The blood is examined using the wet film method (Desquesnes and Davila, 2002).

Table 1: Sensitivity variation of animal inoculation method according to the species of trypanosomes and the experimental animals used

Trypanosome species	Domestic animal affected	Reservoir hosts	Laboratory animal
<i>T.congolense</i>	Cattle, camels, horses, dogs, sheep, goats, pigs	Several group wild mammals	Rats, mice, guinea pigs, rabbits
<i>T.simiea</i>	Pigs	wart hog, bush	Rabbits, monkeys
<i>T.godfreyi</i>	Pigs	Wart hog	None susceptible
<i>T.vivax</i>	Cattle, sheep, goats, domestic buffalo, horses	Several group wild mammals	Usually none susceptible
<i>T.uniforms</i>	Cattle, sheep, goats	Wild ruminants	None susceptible
<i>T.b.brucei</i>	Houses, camels, dogs Sheep, goats cattle, pigs	Several group wild mammals	Rats, mice, guinea pigs, rabbits
<i>T.b.gambiense</i> , <i>T.b.rhodesians</i>	Human sleeping sickness; affect domestic animals	Wild mammals ( <i>T.b.rhodesians</i> )	As for <i>T.b.brucei</i> (after initial adaptation where <i>T.b.gambiense</i> is concerned
<i>T.evansi</i>	Camels, horses, cattle, dog, domestic buffalo	Wild mammals in Latin America	As for <i>T.b.brucei</i>
<i>T.equiperdum</i>	Horses, donkeys, mules	None known	As for <i>T.b.brucei</i> (after initial adaptation

Source: Abebe, 2005

### 3.5 Molecular Tests

New tools developments by molecular biologists now make it possible to characterize trypanosomes both in the vectors and in the hosts. The use of molecular biological tools, in particular the Polymerase Chain Reaction (PCR), introduced an exceptional sensitivity and especially the possibility of characterization at the specific or infra-specific level. This had been impossible previously (IAEA, 2007). The principle of molecular tests (DNA probes, PCR) is the demonstration of the occurrence of sequences of nucleotide which are specific for a trypanosome subgenus, species or even types of strain. Nucleotides are the constituents of DNA (deoxyribonucleic acid), the molecules which constitutes the genes on the chromosomes in the cell nucleus. A positive result indicates active infection with the trypanosomes for which the sequences are specific, as parasite

DNA will not persist for long in the host after all live parasites have been eliminated. These tests are not only suitable for detecting parasites in the mammalian host, but also in the insect vector (Solano *et al.*, 2000).

Molecular biology provides tools for sensitive and specific diagnosis based on DNA sequence recognition and amplification. The PCR permits identification of parasites at levels far below the detection limit of the commonly used parasitological techniques (Geysen *et al.*, 2003). In vitro cultivation, with species identification by techniques such as restriction fragment length polymorphism (RFLP), isoenzyme electrophoresis or DNA hybridization, is possible for some trypanosomes (OIE, 2009).

### **3.5.1 DNA probes (nucleic acid probes)**

The principle of this method is that the sample to be examined is heated to separate the two strands of DNA (this is also called denaturing of DNA), and these are fixed to a membrane, so that cannot recombine again on cooling (IAEA, 2007). A probe is then added. A probe consists of a linear sequence of nucleotides of a certain length, which has been prepared to correspond with a similar sequence of nucleotide in one of the strands of the parasite which the test is means to detect the probe will link (hybridize) with that part of the parasite DNA strand which is the mirror image of the based sequence of the probe (OIE, 2008). Depending on the sequence of DNA that has been selected for the probe, the test can be more or less specific; certain sequences are common to all species of a subgenus. And thus will for example not allow distinguishing among *T.b.brucei*, *T.b.gambiense*, *T.b.rhodesians*, *T.evens* and *T.equiperdum*, but indicating the presences of trypanosomes of the subgenus Trypanozoon. While other sequences are so specific that they only occur in each species, or subspecies, or even type. Whether hybridization has occurred or not is demonstrated by showing that the probe remains fixed to the sample after washing. For this it is of course necessary to “label” the probe and this can be done by incorporating radioactive isotopes in the probe molecule, and showing that the radioactivity persists (Desquesnes and Davila, 2002). Even though, the method is suitable for simultaneously processing large numbers of samples the procedure is long and involves quite a number of steps and DNA probes are requiring (Uilenberg, 1998).

### **3.5.2 The polymerase chain reaction (PCR)**

This is another molecular method of detecting parasite DNA. It is based on an enzyme DNA polymerase, which amplifies (multiplies, copies) sequences of DNA bases, unit sufficient material is produced to be detected. It does so by polymerization (“sticking together”) of nucleic acids (OIE, 2009). Parasite DNA is denatured (separated by heat into the two single strands). Two primers are used, which are short sequences of nucleotides (one for single strands), each constructed so as to be complementary to a specific site on one of the two single parasite DNA strands. The primers attach to the sites for which they are complementary and DNA polymerase then starts to reproduce the rest of each complementary sequence which follows from that primer. This occurs in opposite direction until the entire sequence of double-stranded DNA between the primers has been doubled (as a complementary strand is produced from each primer) (Delespaux *et al.*, 2003). The polymerase can of course only do its work when nucleic acids are added to the test material. The cycle is then repeated, the two double stranded DNA sequences are chain denatured, the primers attach again, and the polymerase amplifies. In the end PCR product is submitted to electrophoresis and bands are detected by special staining (IAEA, 2007).

This diagnosis technique is extremely sensitive, as even minute quantities of parasite and can be amplified into a detectable quantity if the number of cycles is sufficiently high. It can also be highly specific, or less so, depending on the primers available for the reaction. Some primers will amplify a piece of DNA that is specific for a subspecies, type or even strain. A large number of samples can be processed at one time, making it potentially suitable for large-scale surveys (Uilenberg, 1998). The most important negative aspect of this method is false-positive results may occur as a result of contamination of sample with other DNA and the test requires specialized equipments and highly trained personnel, so it is not suitable for use in may laboratories. False-negative results may also occur when the parasitaemia is very low (<1trypanosome/ml of blood), which occur frequently in chronic infections; they may also occur when the specificity of the primers is too high, so that not all isolates of a particular trypanosome species are recognized (Geysen *et al.*, 2003).

## **4. TREATMENT AND CONTROL**

### **4.1 Sanitary Prophylaxis**

Land spray of insecticide, bush clearing and elimination of game animals destroy valuable animal resources and also leads to soil erosion; they have been abandoned (WOAH, 2012).

### **4.2 Control and Eradication of Tsetse Vector**

Several approaches to fly control have been used with varying degrees of success (Mare, 2004). First, insecticides like synthetic pyrethroids applied directly on the animal as a spray or pour-on offers great promise;

insecticide foot bath are also under evaluation. Secondly, the sterile male technique (SIT) which is potentially valuable since females mate only once in a lifetime but production facilities are expensive and can only be applied at the end of the eradication campaign, when the density of remaining flies is very low. Thirdly, the Pheromone baited tsetse traps are used and that attracts and catches tsetse flies: simple, cheap, non-polluting, and readily accepted by local communities. The introduction of odor-baited targets impregnated with insecticides is proving promising as a means of reducing the tsetse fly (Mare, 2004). Good husbandry of animals at risk and avoid contact with tsetse flies is also as much as possible for control. Fifthly, introduction and development of selective cross breeding of trypanotolerant animals has also significance for control. Cattle breeds, like the N'Dama, west African shorthorn, have been in west Africa for centuries and have developed innate resistance to trypanosomes. They are infected by tsetse flies but do not show clinical disease. However, these breeds have not been readily accepted because they are small in size and low in milk producing. Cross breeding is however a common practice (WOAH, 2012). The four Ethiopian cattle breeds Abigar, Gurage, Horro and Sheko in aspects related to trypanotolerance (Desta *et al.*, 2011).

#### 4.3 Chemotherapy and Chemoprophylaxis

Drugs such as Isometamidium chloride and Quinapyramine sulphate and Chloride can be used as prophylactic during transhumance or high seasonal parasitic pressure. Diminazene aceturate and Quinapyramine methylsulfate are drugs which can be used as curative and sanative (WOAH, 2012). But, a very widely used chemotherapeutic drug is Diminazine aceturate (Berenil), which is effective against all three African animal trypanosomes. The Isometamidium drugs are also excellent chemotherapeutic agents as are the quaternary ammonium trypanocides, Antrycide, Ethidium and Prothidium (Mare, 2004). Chemo resistance may occur and care must be taken due to the presence of fake drugs on some markets (WOAH, 2012).

No vaccine is currently available for African animal trypanosomiasis (Mare, 2004). Because of the trypanosomes has the ability to rapidly change variable surface glycoproteins (VSG) in their coats to avoid an effective immune response (antigenic variation). This also leads to establishment of prolonged infections with intermittent parasitaemias. There are estimated to be about 1,000 VSGs, in the trypanosomal coat, which switch genetically as antibodies are produced by the host (WOAH, 2012).

### 5. CURRENT SITUATION OF NAGANA IN SUB-SAHARANS AFRICAN

Tsetse-transmitted Trypanosomosis is an infectious disease unique to Africa and caused by various species of blood parasites. The disease affects both people (Human African Trypanosomosis or sleeping sickness) and animals (Animal African Trypanosomosis or Nagana) and occurs in 37 sub-Saharan countries covering more than 9 million km<sup>2</sup>, an area which corresponds approximately to one-third of the Africa's total land area. Every year, AAT causes about 3 million deaths in cattle while approximately 35 million doses of trypanocidal drugs are administered in sub-Saharan Africa. The Nagana has a severe impact on agriculture economic losses in cattle production alone are in the range of US\$ 1.0-1.2 billion. A pond erated evaluation extrapolated for the total tsetse-infested lands values total losses, in terms of agricultural Gross Domestic Product, at US\$ 4.75 billion per year (FAO, 2010).

The overall impact extends to the restricted access to fertile and cultivable areas, imbalances in land use and exploitation of natural resources and compromised growth and diversification of crop-livestock production systems (Mare, 2004). The presence of tsetse flies and animal trypanosomosis in much of Africa south of the Sahara also had a major influence on the agricultural systems. Large areas of tropical Africa are unsuitable for livestock production due to presence of tsetse flies (Murray *et al.*, 2003). In some Central African countries like the Republic of Gabon, the Republic of Congo, the Democratic Republic of Congo and southern Cameroon there are still extensive areas of relatively undeveloped land. Only trypanotolerant breeds of domestic livestock can be kept here without chemoprophylaxis (OIE, 2008).

The epidemiology of vector-borne diseases is complex due to variability in the ecology of the different actors involved, i.e. parasites, vectors and hosts. Tsetse-borne trypanosomosis is a wide spread protozoal disease-complex affecting wildlife, livestock and people in sub-Saharan Africa, with a range of pathologies, from chronic and long lasting to acute and rapidly fatal, depending on circumstances (Bengaly *et al.*, 2002). The epidemiology of AAT in tsetse infected areas of Africa is determined by four biological factors, namely: trypanosomes, tsetse flies, reservoir hosts and livestock. However, cattle are the domestic species in which the disease is most frequently diagnosed and treated. When dealing with the tsetse-transmitted trypanosomosis, much depends on the distribution and the vectorial capacity of *Glossina* species responsible for transmission (Mbaya *et al.*, 2010).

There are different AAT-control methods currently available (Simarro *et al.*, 2008). In endemic areas of Africa, it can be controlled by reducing or eliminating tsetse fly populations with traps, insecticides and other means, and by treating infected animals with antiparasitic drugs. The selection of trypanotolerant breeds of cattle; animals given good nutrition and rested have been also used to minimize the impact of trypanosomosis. A tsetse fly eradication campaign, the Pan African Tsetse and Trypanosomosis Eradication Campaign (PATTEC), is being conducted in Africa and having a goal of to eliminate tsetse flies from the continent and, with them, to eliminate most animal trypanosomes. Therefore, in sub-Saharan Africa Trypanosomosis occurrences are reduced (OIE, 2009).

## 6. CONCLUSION AND RECOMMENDATIONS

Animal African Trypanosomosis (AAT) or Nagana is tsetse-transmitted trypanosomosis and it is an infectious disease unique to Africa and mainly caused by of blood parasites of *T.vivax*, *T.congolense* and *T.brucei*. Nagana occurs in 37 sub-Saharan countries covering an area which corresponds to approximately one-third of the Africa's total land area. AAT is an economically devastating disease and a major constraint to livestock production in sub-saharan Africa. The clinical signs of AAT are not pathognomonic. Therefore; confirmatory diagnosis of this disease is based on clinical diagnosis, parasitological methods, serological test, animal inoculation and molecular tests. The selection of diagnostic tests to trypanosomosis represent a compromise among its sensitivity, specificity, complexity, that is a number of steps involved, the degree of technical expertise required, its cost and nature of the equipment needed to conduct the tests.

Therefore, based on the above concluding remarks the following recommendations are forwarded:

- Diagnosis of trypanosomosis should be based on clinical signs and followed by laboratory conformation tests.
- The laboratory conformation test should consist of one to the following depending up on the existing facilities in the field and laboratory viz. wet film, thin smear, thick smear, serological tests, animal inoculation and molecular tests.
- Trypanosomiasis must be reported to state or federal authorities immediately upon diagnosis or suspicion of the disease.

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