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Article Review: Trypanosomiasis

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ABSTRACT

A protozoan infection of the disease is impacting both humans and animals in nearly every region worldwide. It can represent a wide range of domestic and wild hosts, including deer, elephants, goats, sheep, dogs, pigs, horses, cattle, buffaloes, and camelids. Due to varying diagnostic techniques such as Giemsa-stained blood smears, molecular assay (PCR), and serological testing, in addition to variations in the spread of Tse tse flies (vector), the prevalence of trypanosomiasis varies between the countries. In Sudan, the prevalence of trypanosomiasis in camels is higher than in other nations; (17% and 51.78%) of cases, respectively, are clinical and non-clinical. Therefore, it is important to utilize accurate diagnostic tests for quick treatment or illness control, as delayed treatment might result in the camels' death.

Keywords- Trypanosomiasis, Tse tse flies, protozoan infection, camels, disease, humans and animals.

I. INTRODUCTION

A protozoan illness caused by trypanosomes that affects both humans and animals is called trypanosomiasis. Sleeping sickness, also known as human African trypanosomiasis, is a parasitic disease spread by vectors. *Trypanosoma* protozoans are the cause of it and humans get the disease by being bitten by tsetse flies (glossina), which acquire the parasites from sick humans or animals affected cattle, horses, buffaloes, camels, goats, sheep, donkeys, pigs, mules, dogs and cats everywhere in the whole world (Sumbria *et al.*, 2014, Mirshekar *et al.*, 2019). Trypanosomes are flagellate protozoa that are unicellular and extracellular, that are members of the genus *Trypanosoma* and the family Trypanosomatidae (Sobhy *et al.*, 2017). Livestock pathological illnesses can lower agricultural productivity, production, and expected profits by as much as 30% in net revenue. In developing countries where the majority of households depend on extended small hold families, this illness has the potential to be fatal, resulting in complete loss and a dire economic disaster. *Trypanosoma brucei gambiense is causes a chronic illness and* found in 24 countries in Central and West Africa and currently makes up 92% of instances that are recorded. An individual may be infected without exhibiting any noticeable symptoms for months or even years. The disease is often advanced and the central nervous system already affected before symptoms become apparent. *Trypanosoma brucei rhodesiense, which produces an acute illness, is found in thirteen eastern and southern African nations. It makes up 8% of instances that have been reported.* After infection, the first indications and symptoms appear a few weeks or months later. The illness spreads quickly and invades several organs, including the brain. (Majekodunmi *et al.*, 2013). Trypanosomiasis can be deadly if it is not recognized and treatment is not started as soon as possible. It causes significant losses in productivity worldwide. American trypanosomiasis, often known as Chagas disease, is mostly found in Latin America. Its

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etiology is a distinct *Trypanosoma* subgenus, its vector of transmission is a separate one, and its symptoms differ greatly from those of HAT (Ereqat *et al.*, 2020).

II. THE SPREAD AND BURDEN OF DISEASE

There are 11 distinct pathogenic trypanosomes are responsible for the severe endemic trypanosomiasis that is prevalent throughout much of Africa. A ccurate molecular detection and characterization on each sample depended on primers specific to each species. "ITS1 CF and ITS1 BR primers were previously used to amplify DNA's internal transcribed spacer (ITS1)" (Njiru *et al.*, 2005). *Trypanosoma vivax*, *T. brucei*, *T. congolense*, *T. Evansi*, and *T. Simiae* are the principal pathogenic Trypanosome species observed; but the first three are the most common in cattle (Ahmad *et al.*, 2016). Several species of trypanosome, including *T. vivax, T. Brucei, T. congolense*, *T. godfreyi*, as well as *T. simiae* are the cause of African Animal Trypanosomiasis (AAT). Despite biting flies, Human African Trypanosomiasis is also caused by two subspecies of *T. brucei* (Isaac *et al.*, 2016). Able to mechanically transfer a few of them. Trypanosomiasis is categorized as a hemoparasite disease. Asia, Africa, and Latin America's cattle industry development is seriously threatened by hemoparasites (Salim *et al.*, 2011a). At the moment, the species affects animals in South America, Central America, Asia, and Northern Africa having expanded well beyond its original range in sub-Saharan Africa. Many underdeveloped nations, like Sudan, where the estimated 4.6 million camels are in danger due to this illness, are quite concerned about it. (Salim *et al.*, 2011b). In both domestic and wild species, Trypanosomiasis is a fatal disease that results in anemia, loss of weight, abortion, and reduced production (Desquesnes *et al*, 2013). Additionally has detrimental effects on the kidney, liver, brain, and spleen, among other organs (Ghaffar *et al.*, 2016). Among the most significant Trypanosoma species is *Trypanosoma evansi* (Fig1). Because of its broad geographic distribution, cattle worldwide become infected. The mechanism of transmission had zoonotic potential, genetic diversity, virulence variation, and pathogenicity to a number of domestic animals, make it a significant parasite. In camels, animal trypanosomiasis caused by *T. evansi* is known as surra and is the most deadly disease affecting 64 camel species globally. (Getahun *et al.*, 2020). In tropical and subtropical countries, *T. evansi* is a dangerous illness that mostly impacts horses and camels. It frequently decrease output and results in financial losses. (Desquesnes *et al*, 2013). In sub-Saharan Africa, *trypanosoma* congolense poses a serious threat to animal health, and the emergence of medication resistance makes treatment of the illness more difficult. (Chitanga *et al.*, 2011).

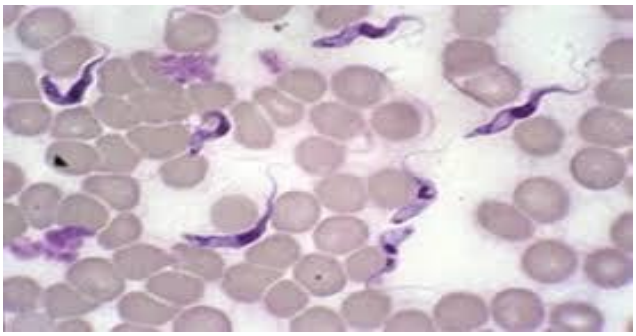

Figure 1: Trypanosoma brucei (Trypomastigote stage, blood smear) Giemsa stain

III. THE LIFE CYCLE AND THE VECTOR

Trypanosomes can be detected in the extravascular and intravascular fluids of various hosts (Alanazi *et al.*, 2018). Hematophagous insects transmitted it mechanically. Trypanosome life cycles, which are split into two phases in the tsetse fly and within the mammalian host, can be regarded as relatively complicated (Dyer *et al.*, 2013).

First, the tsetse fly provides the metacyclic forms into the host, this initiating the trypanosome's life cycle within the mammalian host. Next, triggers the adaptation phase, when the bloodstream within the tsetse fly becomes adapted for the life of the Trypanosome. (Fig2). Morphological characteristics of the metacyclic form include differentiating and multiplying into trypomastigote forms (infective form), which are long, thin bloodstream forms (Dyer *et al.*, 2013) . It may go "from the blood into other bodily fluids, including lymph and cerebrospinal fluid, and can enter the placenta, and from the fluids, the parasite will go to the organs, especially the brain and central nervous system (CNS)". Nevertheless, within the vector, when the tsetse fly feeds on blood, the parasites move to the midgut in trypomastigote forms while still in the circulation. After that, Trypomastigote forms begin to differentiate once they reach the midgut. They go to the salivary gland, trough the esophagus, proboscis, and hypopharynx where they are able to multiply, and in certain cases, change into contagious met acyclic forms (Sharma *et al.*, 2009). There is a noticeable decrease in the number of parasites as they transit from the midgut to the salivary glands (Oberle *et al.*, 2010).

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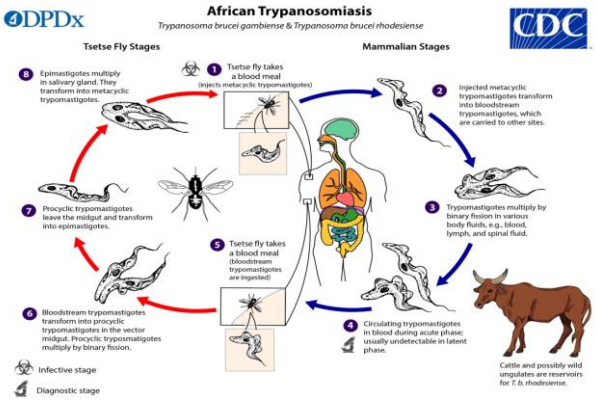

Figure 2: Life cycle of Trypanosoma brucei

IV. TRYPANOSOMA TRANSMISSION

Sleeping sickness is another name for human African trypanosomiasis. A parasite illness spread by vectors. Trypanosoma protozoans are the source of it, and people get it by being bitten by tsetse flies (glossina), which carry the parasites from sick humans or animals (Fig3).

Certain species of tsetse flies carry the illness, and they are found in sub-Saharan Africa. Rural communities engaged in farming, fishing, hunting, or animal husbandry are the most susceptible. HAT is not present in many areas where tsetse flies are present. The disease has a focal distribution ranging from single villages to entire regions, and the incidence can vary from one village to the next (Alanazi *et al.*, 2018).

Figure 3: Tse-tse fly, vector of sleeping sickness

V. PATHOGENESIS

Parasitemia, acute infection produced by *T. vivax* resulted in severe anemia with a reduction of over 70% in the hematocrit value, a high temperature, and a fast deterioration of the patient's physical state. (Parra-Gimenez and Reyna-Bello, 2019). The dourine is a unique illness that exclusively affects Equidae, and the tissue parasite *T. equiperdum*, which is well-suited for sexual transmission, is the cause. (Parra-Gimenez and Reyna-Bello, 2019). related to the high fever and anemia it generates, *T. vivax* causes a serious and sometimes deadly illness in ruminants including buffalo, cattle, goats, and sheep (Gonzatti *et al.*, 2014). A mong clinical manifestations include immunosuppression thrombocytopenia emaciation, fever, anorexia, the development of microthrombi, and furthermore demonstrated is bleeding indicative with disseminated intravascular coagulation (Silva *et al.*, 2016).

Trypanosomiasis can be acute or chronic in nature in camels and horses. Clinical manifestations include sporadic fever, conjunctival petechiae, lacrimation, edema, anemia, swollen lymph nodes, , reduced fertility, abortion, and weight loss that can be fatal (Alanazi *et al.*, 2018). Recurrent fever, anemia, enlargement of the hind limbs, emaciation,weight loss, and hemostatic abnormalities are among the clinical symptoms of *T. evansi* infection (Desquesnes *et al.*, 2013). Severe and sometimes deadly symptoms are linked to T. evansi infections, particularly when the illness is advanced. The illness can be fatally acute or chronic, and it is characterized by increasing depletion, swelling of the lymph nodes, and gradual weakening (Saleh *et al.*, 2009; Herrera *et al.*, 2002).

VI. TREATMENT AND VACCINATION

Trypanosoma infections in people or animals can be lethal,If treatment is not received. Chemotherapy is one of the main ways to manage the infection, although there are a number of drawbacks to the existing treatments, including as their toxicity, limited effectiveness, and the establishment of trypanosome resistance strains (Ahmed *et al.*, 2016). Since *Trypanosoma evansi* is developed resistance to the majority of prescribed medications, other treatments are needed (Dkhil *et al.*, 2020).

Although treatment for *T. evansi* infections in domestic animals often involves the use of diminazene aceturate, but the host can get somewhat toxic from it (Kirchhoff and Rassi Junior, 2011).

Nigella sativa oil (NSO) had a trypanocidal effect as conducted by Nassef *et al.* (2018), however it wasn't as potent as diminazene or cisplatin (Carmo *et al.*, 2015). Thus, the need to find novel, safe medications to treat trypanosomiasis arises (Adeyemi *et al.*, 2018).

At a study, where *T. evansi* was detected in most blood samples, none of the recognized anti-trypanosomes, including Naganol, Cymelarsan, and Antrycide were shown to be effective (Shahjahan *et al.*, 2005). The lack of an economical and effective medicine supply and a mammalian vaccine has made disease control more difficult, leading to epidemic levels of disease prevalence (Aksoy, 2003). Having accurate and sensitive diagnostic techniques is essential for controlling *T. evansi* infections. Additionally, PCR detection methods based on the DNA satisfy these requirements (Aksoy, 2003).

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VII. DISCUSSION

The present review indicated that differences in geographic location, animal management practices, seasons, and the age, sex, and breed of the animals all contribute to variations in Trypnosoma evansi prevalence and dispersion throughout nations. Countries with lower infection rates are those that appear to be more concerned about control efforts. Sudan's camels had the largest percentage of trypnosomiasis cases, with (17% and 51.78%) of cases, respectively, are clinical and non-clinical., respectively. Sixteen publications in total on the frequency and spread of trypnosomiasis among animals throughout various Red Sea nations. This study examined sixteen papers that provided an overview of the present state of trypnosomiasis and the rates at which it is spreading throughout the Red Sea region, including "Saudi Arabia, Sudan, Somalia, and Egypt". For millions of pastoralists in the countries around the Red Sea, camels constitute a major source of food and money. The areas with decreased rates of *Trypnosoma evansi* infections in camel markets may be explained by increased knowledge of proper medication usage, care, and feeding practices, as well as the dependability of camel caretakers on high prices for their animals. The fact that trypanosomosis in camels is chronic and causes the animals to become progressively weaker and emaciated may be the reason why camel infections were more common in camels than in dogs, horses or donkeys. With an estimated 4.6 million camels, Sudan is the world's second-largest camel-rearing nation (**Elamin et al., 1998**). Within each species, the prevalence values vary greatly between nations and are dependent upon the diagnostic technique employed as well as the geographic area covered by the reports. In terms of species, camels had the highest estimated prevalence values, followed by dogs, donkeys, and horses.

VIII. CONCLUSIONS

The conclusion is that Sudan has a higher prevalence of trypanosomiasis in camels than any other country, both in terms of clinical and non-clinical cases. As a result, fast treatment or illness control should be achieved through the use of a trustworthy diagnosis, as delayed treatment might result in death for the animals. This systematic review and meta-analysis research provides comprehensive data on the prevalence of *Trypnosoma evansi* infections in Red Sea nations, geographic distribution, and host range.

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