Prevalence of Trypanosomiasis Among Cattle Slaughtered At Modern Abattoir Gusau, Nigeria

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PREVALENCE OF TRYPANOSOMIASIS AMONG CATTLE SLAUGHTERED AT MODERN ABATTOIR GUSAU, NIGERIA

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ZOOLOGY

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DECLARATION

hereby declare that this project is written by me and it has no been presented before in any ıstitution for a bachelor of science except for quotations and summaries which have been duly cknowledged.

....

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11/12/19

Date

CERTIFICATION

This project entitled "Prevalence Trypanosomiasis among Cattle Slaughtered at Modern Abattoir Gusau, Zamfara State, Nigeria" meets the regulation governing the award of Bachelor of Science of the Federal University Gusau and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

The project is dedicated to Almighty Allah for giving me opportunity to reach this stage of my knowledge.

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ABSTRACT

The paucity of data information and research report on the occurrence of African animals trypanosomiasis in cattle in the Gusau area of zamfara state, Nigeria.The study was carries out in modern abattoir Gusau, Zamfara state. Five millimeter (5ml) of blood samples were collected at the slaughter point from one hundred (100) cattle and transferred into EDTA bottles. The blood sample were collected from cattle as soon as they were slaughtered. Each sample was kept in a cool box containing ice packs immediately after collection and transport to the laboratory for examination. The prevalence of trypanosome in cattle was investigated in slaughter animal at modern abattoir Gusau. A total of one hundred (100) blood sample was collected from male and female cattle at the slaughter point. Out of one hundred (100) blood sample collected 15(15.0%) were infected for trypanosome species (*trypanosome congolence* 9(9.0%), *T. Vivex* 4(4.0%) and *T. brucei* 2(2.0%). This may be attributed to the development of immunity against trypanosome parasite. Regarding to the relationship between age, the rate of infection was highest among in adult between the age 5-7 years.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

African trypanosomiasis is a debilitating disease of human and domestic animals. It is caused by haemoflagelates of the genus: *Trypanosoma,* family: trypanomastidae transmitted by tsetse flies (Glossina spp) (WHO, 1998). The disease is characterized by parasitaemia, fever, anemia, loss of condition reduce productivity and frequently high mortality which among the other factors limit the pace of rural development in tropical Africa (Abenga *et al*, 2007). Trynosomiasis complex by the World Health Organization (WHO) as serious disease lacking effective control measure and all mammalian species are susceptible to the infection. In Africa, countries where trypanosomiasis occurs, it is one of the major public health problems; the epidemiological trend indicated that it is wide spread in 36 sub-Sahara countries for human animal trypanosomiasis (HAT) form and 37 countries for Animal African trypanosomiasis (AAT) types covering over nine million square kilometers between latitude 14°N and 29°S, approximately one third of Africa's total land area (NITR, Annual Report, 1989; Swallow, 2000). Human infection is caused by *Trypanosome brucei gambiense* and *Trypanosome brucei rhodesiense* resulting in sleeping sickness. *T. vivax* and *T. Congolese* on the other hand affect animal predominantly. The current threat of African animal trypanosomiasis ranked among the top ten (10) cattle diseases on sustainable livestock production and mixed farming coupled with failure of vector control as well as chemotherapy/chemoprophylaxis to control the present resurgence of disease, which present a major constraint in the development of the African continent (Abange *et al*, 2002; Samdi *et al*, 2010). These constitute a major threat to attaining food security in several parts of sub-Saharan African and Nigeria. It is currently estimated that about 60 million people and 48 million cattle are at risk of contracting African trypanomiasis from the 23 species and 33 subspecies of tsetse flies infecting 10 million km^2 of African stretching across 49 countries (*Samdi et al*, 2010). The trypanosome species of economic importance in cattle are *Trypanosome conglense, T.vivax, T. brucie*. Tsetse transmitted African trypanosomiasis is responsible for 55,000 human and 3 millions livestock deaths annually and hinders mixed farming through reduced work efficiency of draft animals. The loss in livestock production and mixed agriculture alone is valued at 5 million U.S dollar's yearly in Africa. However effective and sustainable control measures can result in up to 3 fold increase in the current estimated livestock population in Nigeria. The decreased in national and international funding for research and surveillance of trypanosomiasis has resulted in insufficient information on the current status of the disease.

This study seeks to evaluate animal trypanosomiasis among cattle slaughtered at the Gusau modern abattoir using parasitological techniques.

1.2 Statement of the research problem:

There is paucity of data and information and research reports on the occurrence of African animal trypanosomiasis in cattle in the Gusau area of Zamfara state Nigeria

1.3 Justification

i. This study will provide information on the prevalence of animal trypanosomiasis and species of trypanosomes in cattle in order to understand the dynamics of transmission towards possible formulation of control measures in an area so as to described it trypanosomiasis free.

1.4 Aim

The aim of this study was to evaluate the status of animal trypanosomiasis in cattle at slaughter in Gusau modern abattoir.

1.5 Objectives

i. To determine the prevalence of trypanosomiasis among cattle slaughtered at Gusau modern abattoir.

ii. To determine the prevalence of trypanosomiasis with respect to age and in male and female

1.6 Hypotheses

i. The prevalence of trypanosomiasis among cattle slaughtered at Gusau modern abattoir is not high.

ii. The prevalence of trypanosomiasis is not influenced by age and gender of animals.

CHAPTER TWO

LITERATURE REVIEW

2.1 African Animal Trypanosomiasis

African animal trypanosomiasis (AAT) is a disease complex caused by tsetse-fly-transmitted *Trypanosoma brucei brucei*, *T. congolense* or *T. vivax*. African animal trypanosomiais is most important in cattle but can cause serious losses in pigs, camels, goats, and sheep. Infection of cattle by one or more of the three African animal trypanosomes results in subacute, acute, or chronic disease characterized by intermittent fever, anemia, occasional diarrhea, rapid loss of condition and often terminates in death (Mulligan, 1970).

Trypanosoma brucei resides in the subgenus Trypanozoon. Horses, dogs, cats, camels and pigs are very susceptible to *T. brucei* infection. Infection of cattle, sheep, goats and sometimes pigs results in mild or chronic infection (Mulligan, 1970). Although this last observation is widely accepted, (Moulton and Sollod 1976) indicated evidences that this organism is widespread in East and West Africa and that it can cause serious disease and high mortality in cattle, sheep, and goats.

In East Africa, *T. congolenseis* considered to be the single most important cause of animal trypanosomiasis. This trypanosome is also a major cause of the disease in cattle in West Africa. Sheep, goats, horses, and pigs may also be seriously affected. In domestic dogs, chronic infection often results in a carrier state (Mulligan, 1970).

Although *T. vivax* is considered to be less pathogenic for cattle than *T. congolense*, it is nevertheless the most important cause of AAT in West African cattle (Wilson, 1987). This trypanosome readily persists in areas free of tsetse flies (for example, in Central and South America and in the Caribbean), where it is transmitted mechanically by biting flies or contaminated needles, syringes, and surgical instruments (Mulligan, 1970).

2.1.1 Morphology

A sound knowledge of the basic features of the various trypanosomes enables the identification of each species and so the exact cause of the disease. Trypanosomes are classified in the phylum Sarcomastigophora, the order Kinetoplastida and the family Trypanosomatidae (WHO, 1998). The trypanosome consists of a single cell varying in size from 8 to over 50 μ m. There are distinct differences in appearance, shape and size between the various species of trypanosomes, allowing specific identification. The salivaria group of trypanosomes may or may not have a free flagellum, the kinetoplast is terminal or sub-terminal, and the posterior end of the body is usually blunt. They develop as trypomastigotes within the mammalian host and are usually pathogenic (Mulligan, 1970).

2.1.2 Host range

Cattle, sheep, goats, pigs, horses, camels, dogs, cats, and monkeys are susceptible to AAT and may suffer syndromes ranging from subclinical mild or chronic infection to acute fatal disease. Rats, mice, guinea pigs, and rabbits are susceptible and useful laboratory species (Molyneux and Ashford, 1983). More than 30 species of wild animals can be infected with pathogenic trypanosomes, and many of these remain carriers of the organisms. Ruminants are widely known to be active reservoirs of the trypanosomes. Wild equidae, lions, leopards, and wild pigs are all susceptible and can also serve as carriers of trypanosomes (Molyneux and Ashford, 1983).

2.1.3 Transmission and distribution

In Africa, the primary vector for *T. congolense*, *T. vivax*, and *T. brucei* is the tsetse fly. These trypanosomes replicate in the tsetse fly and are transmitted through tsetse fly saliva when the fly feeds on an animal. The three main Species of tsetse flies for transmission of trypanosomes are *Glossina morsitans*, which favors the open woodland of the savanna; *G. palpalis*, which prefers the shaded habitat immediately adjacent to rivers and lakes; and *G. fusca*, which favors the high, dense forest areas. The distribution of the tsetse transmitted African trypanosomes is governed by that of their tsetse vectors, which infest an area of sub-Saharan Africa that extends from the southern edge of the Sahara desert (lat. 15°N.) to Angola, Zimbabwe, and Mozambique (lat. 20S.) . Trypanosomosis is also mechanically transmitted by tsetse and other biting flies through the transfer of blood from one animal to another. The most important mechanical vectors are flies of the genus Tabanus, but Haematopota, Liperosia, Stomoxys, and Chrysops flies have also been implicated. In Africa, both *T. vivax* and *T. brucei* have spread beyond the "tsetse fly belts" where transmission is principally by tabanid and hippoboscid flies. Of the three African animal trypanosomes, only T. vivax occurs in the Western Hemisphere in at least 10 countries in the Caribbean and South and Central America.

2.1.4 Pathogenesis and clinical signs

Initial replication of trypanosomes happens at the site of inoculation in the kin; this causes a swelling and a sore (chancre). Trypanosomes then spread to the lymph nodes and blood and continue to replicate. *T. congolense* localizes in small blood vessels and capillaries. *T. brucei* and *T. vivax* localize also in tissue. Antibodies developed to the glycoprotein coat of the trypanosome lyse the trypanosome and result in the development of immune complexes.

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 (Kalu *et al.*, 1989). Immunologic lesions are significant in trypanosomosis, and it has been suggested that many of the lesions (e.g., anemia and glomerulonephritis) 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 immunosuppression that occurs following infection by these parasites. This marked immunosuppression lowers the host's resistance to other infections and thus results in secondary diseases, which greatly complicate both the clinical and pathological features of Trypanosomosis (Kalu *et al.*, 1989).

Because simultaneous infections with more than one trypanosome species are very commo and simultaneous infection with trypanosomes and other hemoparasites (Babesia spp., Theileria spp., Anaplasma spp., and Ehrlichia spp.) frequently occurs, it is difficult to conclude which clinical signs are attributable to a given parasite. Few adequately controlled studies have been made, and thus a "typical" clinical response to each trypanosome is difficult to reconstruct.

The cardinal clinical sign observed in AAT is anaemia. Within a week of infection with the haematic trypanosomes (*T. congolense* and *T. vivax*) there is usually a pronounced decrease in packed cell volume (PCV), haemoglobin and red blood cells, and within 2 3 months the PCVs may drop to below 30 percent of their preinfection values. Also, invariably, present are intermittent fever, oedema and loss of condition. Abortion may be seen, and infertility of males and females may be a sequel. The severity of the clinical response is dependent on the species and the breed of affected animals and the dose and virulence of the infecting trypanosome. Stress, such as poor nutrition or concurrent disease, plays a prominent role in the disease process.

Haemorrhagic T. vivaxstocks have been isolated from East Africa. These stocks cause a hyperacute disease, characterized by high parasitaemia, severe anaemia and haemorrhages, which have been related to intravascular disseminated coagulation (DIC). Cattle may die within 2 weeks or, under favourable conditions, rapidly self-cure after 2 months.

2.1.5 Epidemiology

The epidemiology of African Animal Trypanosomosis depends on three actors, which are the distribution of the vectors, the virulence of the parasite and the response of the host. When we are dealing with the tsetse-transmitted trypanosomosis, much depends on the distribution and the vectorial capacity of the Glossina species responsible for transmission. Of the three groups of Glossina, the savannah and riverine are the most important since they inhabit areas suitable for grazing and watering. Although the infection rate of Glossina with trypanosomes is usually low, ranging from 1 20% of the flies, each is infected for life, and their presence in any number makes the rearing of cattle, pigs and horses extremely difficult (Urquhart et al., 1987). Where savannah tsetse are the vectors, the risk of contracting the disease is widespread. When the riverine species are the culprits (in many parts of West and Central Africa), transmission occurs particularly along rivers with dense vegetation along the banks. The proportion of a tsetse population found infected with pathogenic trypanosomes depends not only on its vector capability, but also on the host on which it mainly feeds. For example, repitiles do not carry pathogenic trypanosomes, and there are also major differences between suids and bovids, as the former will infect the flies particularly with *T. simiae* and T. godfreyi, while bovids are mainly the source of *T. vivax* and *T. congolense* (Maikaje, 1998). Biting flies may act as mechanical vectors, but their significance in Africa is still undefined. However, in Central and South America, *T. vivax* is thought to be transmitted readily by such flies (Urquhart *et al.*, 1987).

The parasite virulence, immunogenecity and response to chemotherapeutics are also important factors in the epidemiology of trypanosomosis as the trypanosome species occur in a remarkable variety of genotypes. Since parasitaemic animals commonly survive for prolonged periods, there are ample opportunities for fly transmission, especially of *T. brucei* and *T. congolense*. In contrast, some strains of *T. vivax* in cattle and *T. simiae* in domestic pigs kill their hosts within 1 2 weeks, so that the chances of fly infection are more limited (Urquhart *et al.*, 1987).

Species and breed susceptibility are also important in the epidemiology of trypanosomosis as animal hosts differ in their response to trypanosome infection, depending on the species and breed of the individual animals. The level of animal husbandry practices, nutritional status, work load and stress exacerbate the severity of the disease (Urquhart et al., 1987). The fact that the parasite affects not only cattle but also wild animals which constitute the reservoirs of the disease, makes the epidemiology of animal trypanosomosis extremely complicated.

2.1.6 Diagnosis

The primary reason for diagnosis of animal trypanosomiasis is for the appropriate application of therapeutic and prophylactic measures. Other reasons for diagnosis include the need to target and monitor tsetse control or eradication operations, investigations into the efficacy of chemotherapy and particularly trypanocidaldrug resistance, and pathophysiological, epidemiological and socio-economic studies.

The type of diagnostic test used in the detection of infections caused by the animal trypanosomoses will vary according to the epidemiological characteristics of the disease and the strategy for control. Where tsetse-transmitted trypanosomoses occur and where disease prevalence is high, even tests of low diagnostic sensitivity will suffice if chemotherapy or chemoprophylaxis is administered on a herd basis. However, in many situations where mechanically transmitted trypanosomiasis found, drugs are often administered therapeutically to individual infected animals and it is essential that more sensitive diagnostic tests be used in order to detect active infections.

Similar considerations also apply after control campaigns. As the disease prevalence declines, the need for individual treatment as apposed to block treatment becomes an important issue. When chemotherapy has been applied in areas where drug resistance is known to exist, it is also necessary to detect rapidly any failure in treatment.

2.1.6.1 Clinical diagnosis

Clinical signs of acute bovine trypanosomosis include anaemia, weight loss, roughness of the hair coat, enlargement of peripheral lymph nodes, pyrexia, abortion, reduced milk yield and, in the absence of treatment, death. Hence, trypanosomosis should be suspected when an animal in an endemic area is febrile, anaemic and in poor condition (Kalu *et al.*, 1989). The clinical picture depends to some extent on the species of infecting trypanosomes and the susceptibility of the bovine host. Diagnosis of the disease based on clinical manifestations is complicated due to the fact that the disease may have acute, chronic or sub-clinical forms. Confirmation depends on the demonstration of the organism in blood or lymph node smears using the parasitological methods available

2.1.6.2. Parasitological diagnosis

The conventional techniques of microscopic examination for the presence of trypanosomes are still widely used, but newer and far more sensitive methods are beginning to supplant them.

Blood films

In the early phases of infection, especially with T. vivax and T. congolense, the parasite can readily be observed by microscopic examination of a wet-mount of blood slides. This method is relatively less sensitive, with a detection limit of about 8.3 x 103 trypanosomes per ml of blood (Paris *et al.*, 1982). A drop of fresh blood is taken from the ear vein of an animal with a microscope slide and covered with a glass slip. This preparation is examined microscopically with light or phase contrast microscope at 400x magnification. From the relative size and movement pattern of the parasite, it is possible to guess on the species of the parasites involved, to be confirmed by stained preparation.

Thin and thick blood smears fixed in methanol or acetone and stained with Giemsa may be used in the laboratory to detect blood parasites and determine the trypanosome species involved, respectively. Stained lymph node smears are a very good method for diagnosis, especially for *T. vivax* and *T. brucei*. In chronic *T. congolense* infection, the parasites localize in the microcirculation of the lymph nodes and in other capillary beds, allowing diagnosis by examination of lymph node smears or smears made with blood collected from the ear. Early in infection, blood smears are optimal for the demonstration *of T. congolense.*

These techniques are not sensitive enough to detect low parasite levels, characteristic of the disease in large animals at the chronic stage (Woo, 1970; Murray et al., 1977), and as a result several techniques for the concentration of blood trypanosomes have been developed, which increase the chance of trypanosome detection.

2.1.7 Control of African Animal Trypanosomosis

Prevention and control of tsetse-transmitted trypanosomosis depends on methods directed to the vectors, the host and the parasites. Each of these approaches is useful but has important limitations, such as expense, environmental pollution and drug resistance.

2.1.8 Vector control

Several approaches to fly control have been used with varying degrees of success. Many methods widely used for tsetse control in the past have ceased to be used in the last 10-20 years, either because they were ineffective, or because they have become environmentally unacceptable. Discriminative bush clearing, extensively used in early tsetse fly eradication campaigns, has been locally useful because it eliminates the breeding places of the tsetse. But, to be completely effective, bush clearing requires destruction of vast areas of bush and forest, which is ecologically unacceptable. It is still a useful procedure when used locally in conjunction with other control methods. Game elimination, and thus elimination of the main source of blood meals for the tsetse, was used in early eradication campaigns. This was an ineffective and wasteful procedure. Today, the method has been abandoned, to a large extent on environmental and ethical grounds (Maikaje, 1998).

Ground and aerial spraying with insecticides and the use of synthetic pyrethroids on cattle have lowered fly densities in some areas, but widespread use would require considerable international cooperation and expense. Widespread application of insecticides has the tremendous disadvantage of also eradicating many other arthropods, several of which are desirable (Maikaje, 1998). Although few long-term environmental effects of aerial spraying of insecticides have been shown, alternatives to the wide-scale application of insecticides are preferred, and the technique is no longer commonly used. Aerial spraying was formerly used to apply non-residual, contact insecticides, particularly endosulfan, by sequential aerial spraying using Ultra-Low-Volume (ULV) techniques.

There has been a substantial amount of research for more environmentally acceptable techniques because the widespread use of persistent insecticides or drastic habitat modification is no longer acceptabl. These include the use of insecticide-impregnated traps or targets and non-impregnated traps and, more recently, the use of 'pour-on' insecticides applied to cattle. Whilst still depending upon insecticides, the quantities used are much smaller, and the types used are predominantly synthetic pyrethroids with high toxicity for Glossina spp. but low mammalian toxicity. Furthermore, they are not widely distributed in the environment but are much more closely directed at the specific target organism.

Application of the sterile male technique (as used in screwworm eradication in the United States) received considerable attention in the 1980's. Large numbers of male flies, usually sterilised by irradiation, are released and compete with wild males to mate with female flies. Early problems with breeding of the male flies have been overcome, and field trials have been done in both East and West Africa to determine the effectiveness of this approach in vector control. In limited trials, this procedure has reduced fly populations. It has been used successfully in Burkina Faso, Tanzania, Nigeria and, most recently, in Zanzibar where it eradicated Glossina austenifrom the 1600 km2 Unguja Island (Feldmann and Hendrichs, 1998). This method of control is costly, technically demanding and only suitable for relatively small, isolated areas of tsetse infestation.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study area.

The study was carried out in modern abattoir Gusau, Zamfara State. Gusau Local Government, which is also the state capital and is located in southwest of Zamfara State. The size of the town is 3,364 km^2 with a population of about 383,162 (NPC, 2006). Its population is mostly Hausa and Fulani, with other tribes. The annual rainfall ranges between 1000-1,071 mm, with two distinct seasons. The rainy season start from May - October and dry season is from November - April.

3.2 Sample collections

Five millimeters (5 ml) of blood samples were collected at the slaughter point from one hundred (100) cattle and transferred into Ethylene Diamine Tetra Acetic Acid (EDTA) bottles (Onyiah *et al*, 1997). The blood samples were collected from cattle as soon as they were slaughtered. Each sample was kept in a cool box containing ice packs immediately after collection and transported to the laboratory for examination. Parasitological examination was carried out using the standard Trypanosome detection method of hematocrit centrifugation techniques, thick method, plasticel, glass slide. The smear was observed under oil lens; the packed cell volume of each animal were also be determined.

3.3 Procedure

A sample was collected from modern abattoir among the cattle from both male and female at modern abattoir, Gusau and transported directly to the Zoology Laboratory of Federal University, Gusau.

Thick method was used for detection of trypanosome. Put one drop of blood at the center of glass slide was made on a good smear and allowed to air dry. The smear was fixed in methanol solution. Giemsa solution was added and allowed for 30-45 minutes. Thereafter, the stain was washed off under running water and allowed to dry. A drop of oil immersion was placed on the stained slide and trypanosomes were viewed under x100 objective lens of a light microscope.

3.4 Data analysis

The data obtained were analyzed using simple percentages.

CHAPTER FOUR

RESULTS

4.0 Major Findings

A total of 100 blood samples collected from males and females cattle at slaughter at Gusau modern abattoir is shown in Table 1. Out of the 100 cattle sample, 15 (15.0%) were infected with trypanosomes.

Table 4.1: Prevalence of trypanosome species in cattle slaughter at Gusau modern abattoir

Species	Number of cattle infected	Prevalence (%)
Trypanosoma congolence	9	9.0
Trypanosoma vivax	4	4.0
Trypanosoma brucei	2	2.0
Total	**15**	15.0

Table 4.2: Prevalence of trypanosome species in cattle slaughter in *Gusau modern* abattoir in relation to males and females

Gender	Number of examined	Number of infected
Male	40	4
Female	50	11

Table 4.3: Prevalence of trypanosome in relation to [illegible]

Age (years)	No. of examined	No. of infected
1-4	20	0
5-7	80	15

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Discussion

The overall prevalence of this study shows that trypanosome parasites are common to cattle in modern abattoir Gusau, Zamfara state. An overall infection rate 15(15.0%). The prevalence of trypanosome parasites (15.0%) was higher *in trypanosome congolence* and low in *T. vivax*.

5.2 Conclusion

The study has shown that, trypanosomiasis is a prevalent disease among cattle slaughtered in the Gusau modern abattoir despite the un-official declaration of the absence of tsetse fly in the area. Trypanosomiasis was more prevalent in adult cattle.

5.3 Recommendation

- Health education should be provided to the farmers and consumers.
- Proper management system should encoraging.
- Correlation to seasonal and livestock migration pattern should be uniformly applied.
- Investigation and regional control of outbreaks.

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