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Susceptibility of Sudanese Nubian Goats, Nilotic Dwarf Goats and Garag Ewes to Experimental Infection with a Mechanically Transmitted *Trypanosoma vivax* Stock

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Abstract: The present study was conducted to study the susceptibility of two different types of Sudanese goats namely: Black Nubian, the Nilotic dwarf goats and ewes of Garag type to experimental infection with *Trypanosoma vivax* stock isolated from cattle outside tsetse area. The infection caused parasitaemia, anaemia and pyrexia in the infected goats. However, the Nilotic dwarf goats were more tolerant to the infection than the Nubian goats, showing significantly higher values of packed cell volume, haemoglobin concentration, total red and white blood cells counts and significantly low parasitaemia and low body temperature. Garag ewes which were found to be susceptible to *T. vivax* infection showed different signs of anaemia and pyrexia; it is recommended that comparative studies on sensitivity of this type and other different Sudanese types of sheep to Trypanosomosis should be conducted.

Key words: *Trypanosoma vivax*, mechanical transmission, trypanotolerance

INTRODUCTION

Trypanosomosis is an arthropod borne disease transmitted by tsetse or other biting flies. It's widely distributed in different parts of the Sudan. Inside the tsetse belt the disease is mainly transmitted cyclically by tsetse flies, while outside that belt *Tabanids* and *Stomoxys* flies are suspected to be the main mechanical vectors of the disease. Trypanosomosis of all animal species was regarded as the most serious disease problem of animals in the Sudan since the beginning of the last century (Anonymous, 1907). Karib (1961) pointed out that bovine Trypanosomosis is one of the major animal diseases in the Sudan; he indicated that *T. vivax* is the commonest trypanosome encountered in cattle outside the tsetse belt.

Recently, mechanically transmitted Trypanosomosis rose to be a major economic problem (Abdel Rahman, 2005). Seven species and sub species of tsetse flies (*Glossina*) have been recognized in the Sudan (Lewis, 1949). They were concentrated at different foci in Southern, South Western and South Eastern Sudan along Sudan Ethiopian borders. They occupy a total area of about 300.000 km^2 of the good fertile soil of the country. Seventy species of tabanids (Lewis, 1953) and six *Stomoxys* species are known to exist in the Sudan (Lewis, 1954), they are distributed over wide different ecological zones in the country.

Previous studies showed that Nubian goats are highly susceptible to *T. vivax* infection (Osman, 2005) while Nilotic dwarf types though susceptible but showed more tolerance to the infection (Kaila, 2005). The present study was conducted to assess the differences in susceptibility of these goats to Trypanosomosis between these two types of goats. The study of Trypanosomosis in Garag ewes is part of studies concerning recognition of trypanotolerant types of sheep in the Sudan.

MATERIALS AND METHODS

Trypanosoma vivax was isolated from blood of confirmed naturally infected cattle at Kenana district (White Nile State). The infected blood was inoculated intravenously in goats at site of collection and then transferred to the Central Veterinary Research Laboratories in Khartoum, Sudan. Blood samples were collected from the infected goats and preserved in liquid nitrogen.

Nubian goats are found in Northern Sudan (tsetse free area) while Nilotic dwarf goats are distributed in Southern Sudan (tsetse infested area). Garag sheep is a cross type between the large desert sheep and the Nilotic dwarf type, it is kept by Baggara tribes in the cattle rearing zones of the Sudan.

Experimental animals consisted of twelve goats of Nubian and Nilotic dwarf types aged 11-12 months old. They were purchased from Khartoum and Juba

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(Southern Sudan), respectively and six Garag ewes, 12 to 15 months old were purchased from Upper Nile (Southern Sudan). All the animals were kept at fly-proof premises at the Central Veterinary Research Laboratories, Soba, Khartoum. Animals were ear-tagged, examined for the presence of trypanosomes and other blood parasites using wet blood smears, thin stained blood films and concentration methods (Kendrick, 1968). They were also examined for the presence of internal and external parasites. The animals were treated with Albendazole, Oxytetracycline Hydrochloride and Sulphadiamidine sodium and sprayed by Asuntol as an acaricide. They were fed on dry sorghum hay and concentrates and had free access to water.

Five Nubian goats, three Nilotic dwarf goats and three Garag ewes were experimentally infected IV with *T. vivax* using a dose of 10^4 trypanosome mL^{-1} blood. while four goats of both types and three ewes were used as uninfected control.

Parasitaemia was estimated according to Paris *et al.* (1982) using the dark ground buffy coat technique. Rectal temperatures were taken twice weekly while body weight was recorded every two weeks.

Experimental animals were bled twice weekly for 16 week post infection. Blood was collected from ear veins into capillary tubes to determine level of parasitaemia. Whole blood was used for haematological investigations according to Schalm *et al.* (1975).

Statistical analysis was performed using STATISTICA Programme Version 5. The level of significance was $p<0.05$.

RESULTS AND DISCUSSION

No significant difference was observed in prepatent period between the experimentally infected Nubian and Nilotic dwarf goats. The level of parasitaemia in black Nubian goats was significantly higher than that of the Nilotic dwarf goats ($p<0.05$). Significant increase of body temperature was observed in infected goats when compared with the uninfected control. A significant increase in temperature was observed in infected Nubian goats when compared with infected Nilotic dwarf goats ($p<0.05$). No significant difference in mean body weight gain was observed between the infected and uninfected goats (Table 1).

Haematological changes in blood of experimental goats are shown in Table 1. A significant decrease of PCV, Hb values, RBCs and WBCs counts were detected in all infected goats compared to the uninfected control group. On the other hand, significant decreases in these parameters were also observed in infected Nubian goats when compared with the infected Nilotic dwarf goats.

Table 1: Mean values of prepatent periods, parasitaemia, body temperature, body weight gain and haematological parameters of goats experimentally infected and uninfected with *Trypanosoma vivax*

Parameters	Control goats	Infected nubian goats	Infected nilotic dwarf goats
Prepatent period (days)	-	4.20±1.64[a]	4.33±2.31[a]
Parasitaemia ×(10^5 mL^{-1} blood)	-	0.69±0.91[a]	0.06±0.27[b]
Body temperature (°C)	38.35±0.68[a]	38.70±0.78[b]	38.53±0.72[c]
Body weight Gain (kg)	0.25±1.14[a]	0.27±1.61[a]	0.08±0.43[a]
PCV (%)	29.78±1.75[a]	19.14± 2.62[b]	21.47±3.81[c]
Hb (g dL^{-1})	9.27±0.78[a]	6.27±0.86[b]	7.25±1.23[c]
RBCs (×10^6 mm^{-3})	14.09±1.30[a]	9.62±1.65[b]	10.34±2.11[c]
WBCS (×10^3 mm^{-3})	9.46±1.59[a]	6.04±0.46[b]	8.09±1.62[c]

Values in the same row followed by different letter(s) are significantly different, Significant differences were observed at $p<0.05$

Table 2: Mean values of parasitaemia, body temperature, body weight gain and haematological parameters in Garag ewes experimentally infected and uninfected with *Trypanosoma vivax*

Parameters	Control garag ewes	Infected garag ewes
Parasitaemia (×10^5 mL^{-1} blood)	-	7.670±11.38
Body temperature (°C)	38.510±0.60	39.020±0.75*
Body weight gain (kg)	0.590±1.12	-0.220±0.97
PCV (%)	25.813±1.93	19.268±1.87*
Hb (g dL^{-1})	9.158±0.69	7.160±0.86*
RBCs (×10^6 mm^{-3})	8.790±0.94	6.970±0.76*
WBCs (×10^3 mm^{-3})	7.185±1.02	6.580±1.61

*: Significant differences were observed at $p<0.05$

As for Garag ewes, the study showed significant increase of body temperature in infected ewes compared with the control ($p<0.05$). No significant difference was observed in mean body weight gain between the two groups. While a significant decrease ($p<0.05$) of PCV, Hb, RBCs and WBCs values of infected group when compared to the control group (Table 2).

The results of the present study describes that *T. vivax* stock used was infective for types of goats used and Garag ewes.

The results indicate variations in the intensity of parasitaemia and pyrexia between infected Nubian goats and dwarf Nilotic goats. The infected Nubian goats had significant higher parasitaemia levels and body temperature. The peaks of parasitaemia in some cases coincided with rise in body temperature. No significant change was observed in body weight gain in infected and uninfected goats. This finding disagrees with that of Faye *et al.* (2005) who reported decrease in body weight gain in West African dwarf goats experimentally infected with *T. congolense*.

Significant decrease in PCV, HB, RBCs and WBCs were observed in goats of both types compared with the controls. These findings were supported by the findings of (Van den Ingh *et al.*, 1976; Saror, 1980) regarding *T. vivax* infection in goats. The dwarf Nilotic goats were found to be superior to the black Nubian goats in controlling parasitaemia and resisting anaemia.

The Nilotic dwarf type of goats was considered trypanotolerant since they were able to control parasitaemia and resist anaemia and pyrexia. On the other hand, Trypanosomosis affected Nubian goat's health as showed by the severe anaemia, high parasitaemia and body temperature.

Since the goats used in this experiment has no history of contracting the non-tsetse *T. vivax* stock, the resistance expressed by the Nilotic dwarf goats could be due to innate resistance that developed over several years of exposure to natural infections. Dargie *et al.* (1979) reported that trypanotolerant animals had the ability to control parasitaemia rather than resist RBCs destruction or mount a more efficient erythropoietic response. Murray *et al.* (1982) pointed out that while the basic mechanism of trypanotolerance is still to be precisely defined, there is at least a circumstantial evidence that the mechanism is related to a host response factor and that it is a heritable trait. Previous studies reviewed by Murray *et al.* (1991) indicated that the ability to control the level of parasitaemia and the development of anaemia are key indicators of trypanotolerance that are genetically controlled.

Garag ewes showed high susceptibility to *T. vivax* infection. This was indicated by the significant rise in body temperature which could indicates metabolic activity and also significant decrease in PCV, HB and RBCs values in the infected ewes. These findings agree with that of Katunguka *et al.* (1992) in sheep experimentally infected with *T. congolense*. The results also indicate significant decrease in WBCs values in infected ewes. Similar findings were reported by Maxie *et al.* (1979) and Bengaly *et al.* (1993) who also reported leucopaenia in experimental trypanosome infection with *T. congolense* and *T. vivax* in cattle and small ruminants. Their findings disagree with that of Ogunsanmi *et al.* (1994) who reported normal leucocytes count in the acute phase and leucocytosis in the chronic phase of infection in ewes experimentally infected with *T. brucei.* Onah *et al.* (1996) also reported leucocytosis in experimentally infected sheep with *T. evansi.* No significance difference was observed in body weight gain between infected and uninfected ewes, however, infected ewes seems to have lesser body weight gain than uninfected ones and it is in an agreement with that of Katunguka *et al.* (1995) who found a decrease in body weight gains in Scottish Blackface sheep experimentally infected with *T. congolense*.

As realized from this study pyrexia was a major sign of the infection in goats and ewes. This indicates metabolic disorder due to the presence of circulating trypanosomes and their by-products which could also play a significant role in the process of haemolysis and consequently the observed fall in PCV, similar findings was reported by Edwards *et al.* (1956).

Anaemia and leucopaenia were distinct features of the disease in infected goats and ewes experimentally infected with *T. vivax*. Anosa (1988) stated that anaemia and leucopaenia are cardinal signs of trypanosomosis and Murray and Dexter (1988) who reported that anaemia in trypanosomosis might be due to the haemolysins induced by the trypanosomes, different immunological factors, increased erythrophagocytosis, haemodilution and dyshaemopoiesis. They stated that the possible mechanisms that might be responsible for leukopaenia are similar to those discussed for anaemia.

Dwarf Nilotic type may be used as a source of meat in the tsetse infested areas of Sudan where local people traditionally do not keep animals and are lacking animal's protein. As the Garag sheep type seems to be very sensitive to trypanosomosis just like the Desert type, further studies are required to investigate the trypanotolerance trait in the Nilotic sheep type.

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