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Haemoparasites and Haematological Parameters of the One Humped Camel (*Camelus Dromedarius*) Slaughtered in Maiduguri Abattoir, Nigeria

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Haemoparasites and Haematological Parameters of the One Humped Camel (*Camelus Dromedarius*) Slaughtered in Maiduguri Abattoir, Nigeria

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Abstract- Haemoparasitic diseases account for substantial losses in terms of decreased working capacity, growth and productivity of camels. A survey of the one humped camel (*Camelus dromedarius*) slaughtered in Maiduguri was conducted from January to June, 2016 to determine the prevalence of haemoparasites and their effects on some haematological parameters. Blood samples were randomly collected from 209 camels at the point of slaughter and subjected to standard haematological procedures to determine the white blood cell count (WBC), packed cell volume (PCV), haemoglobin concentration (Hb), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC). Blood films and Giemsa stained thin smears were prepared on clean glass slides and examined for the presence of haemoparasites. Haemoparasites were identified microscopically to generic level based on morphological features. A total prevalence of 12.6% was recorded for *Anaplasma* (37.7%), *Trypanosoma* (33.3%) and *Babesia* (22.2%), in addition to microfilariae of *Dipetalonema* species (7.5%). The haematological parameters of infected and uninfected camels were within normal range but, there was a significant difference ($p < 0.05$) in Mean \pm SE RBC counts of infected and uninfected camels, while the Mean \pm SE PCV, Hb, WBC, MCV, MCB and MCHC were comparable ($p > 0.05$). We report the first occurrence of *Dipetalonema* species in one humped camel in Maiduguri. The role of camels as carriers or reservoir of haemoparasites for other species of domestic animals in Maiduguri is suspected. Routine screening, treatment including preventive chemoprophylaxis and vector control is recommended. There is also need for molecular studies to identify various species of haemoparasite circulating in trade camels in Maiduguri.

Keywords: camels, haemoparasites, haematological parameters, maiduguri, prevalence.

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I. INTRODUCTION

Nigeria has an estimated 87,000 camels of which 30.9% are found in Borno state (FDLPCS). Camels are highly adapted to the semi-arid environments and are confined to the northern borders of Sokoto and Borno states in Nigeria (Schwartz and Dioli, 1992; Blench, 1999). They contribute significantly to the food security of the nomadic pastoral households (El-Naya and Barghash, 2016) and economy of northern Nigeria (FDLPCS, 1992), in addition to their work ability, environmental conservation and the provision of meat and milk (Chafe *et al.*, 2003). Despite their role as a member of the food producing family of livestock, camels have for a long time remained the most neglected animal in the field of scientific research. Furthermore, camels are hardy animals that have a strong adaptation to the harsh weather conditions of arid regions because of their unique physiological characteristics (Karimi *et al.*, 2014).

Camels are known to suffer from various types of parasitic diseases which are major constraint in improvement of camel health (Parsani *et al.*, 2008). Haemoparasitic diseases such as Anasplasmosis, Babesiosis, Trypanosomosis, Theileriosis and Dipetalonemiasis have adverse effects on the health, growth, productivity and working capacity of camels (Ahmad *et al.*, 2004). Various species of haemo-parasites have been reported in camels in Nigeria (Egbe-Nwiyi and Chaudhry, 1994; Bamaiyi *et al.*, 2011) and elsewhere (Abdelrahim *et al.*, 2009; Swelum *et al.*, 2014; Faham *et al.*, 2015; El-Naya and Barghash, 2016). Among haemoparasitic diseases of camels, trypanosomosis also known as "sura" is one of the important and serious disease caused by *Trypanosoma evansi* (Soulsby, 1982). It is mechanically transmitted non-cyclically by haematophagous flies such as *Tabanus*, *Stomoxys* and *Hippoboscids*, which are common in Africa, Nigeria inclusive (Agbede, 2013; Eyob and Matios, 2013). Trypanosomosis in camels usually occurs in chronic form but may be acute when the animal is under stress (Parsani *et al.*, 2008). In the acute form, clinically affected camels show fever, anorexia, marked

generalized oedema, deteriorate rapidly and die while in the chronic form, there is intermittent high fever, progressive loss of body weight, marked generalized muscular atrophy and occasionally abdominal oedema (Eyob and Matios, 2013). Piroplasmiasis due to tick-borne Anaplasma, Babesia and Theileria species have also been reported in Camels in Nigeria (Bamaiyi *et al.*, 2011) and elsewhere (Swelum *et al.*, 2014; El-Naya and Barghash, 2016).

Extra intestinal filarid nematodes like Onchocerca, which produces microfilaria have been reported in camels (Parsani *et al.*, 2008). *Onchocerca fasciata* produces subcutaneous nodules on the head and neck regions while *Dipetalonema evansi* occurs in blood vessels in the spermatic cord, pulmonary arterial tree, right auricle, lymph nodes and mesentery. The microfilaria is sheathed and found in the blood circulation. Basic diagnosis of haemoparasitism relies on clinical symptoms, haematological evaluations and microscopic examinations of blood film or blood smear (Soulsby, 1982).

There has been a steady increase in the number of camels slaughtered for human consumption, as an alternative to goat, sheep and cattle meat in Maiduguri. The increased demand on camel meat is also accompanied by a corresponding rise in prevalence of haemoparasites among them (Egbe-Nwiyi and Chaudhry, 1994; Bamaiyi *et al.*, 2011). It is against this background that this study was conducted to ascertain the prevalence rate of haemoparasites in slaughtered camels so as to design a better preventive and chemotherapeutic approach that could fit into policy formulation in the region.

II. MATERIALS AND METHODS

a) Study Area and Population

Maiduguri is located in the North east arid zone of Nigeria between Latitude 11° N and Longitude 13° E, and shares international boundaries with Republics of Niger and Chad in the north and Cameroon in the east. It is characterized by a long period of dry season which lasts from October to May and a short period of rainfall from June to September (Hess *et al.*, 1995). The State derives great economic activity from its rich livestock and fishery products (NPC, 2006). Camels are important trade livestock in Maiduguri and also used for meat and milk in addition to their use as portage animals in rural localities. The camels used for this study were trade stock presented for slaughter at the Maiduguri abattoir. The sex were differentiated based on appearance of external genitals while aging was based on rostral dentition as described by Bello *et al.* (2013). Thus, camels <5 years were categorized as young while older (>5years) ones were regarded as adults.

b) Study Design and Sample Collection

A cross-sectional study was conducted from January to June, 2016, to investigate the occurrence of haemoparasites and associated changes in some haematological parameters of slaughtered camels. A total of 209 camels were randomly selected at the point of slaughter, and the age and sex of each sampled animal were observed and recorded appropriately. 10ml of blood was collected into two labelled bottles containing sodium EDTA, by jugular venipuncture at the point of slaughter. The samples were submitted to the Veterinary Parasitology and Pathology Laboratories for parasitological and haematological examinations, respectively.

c) Parasitological Examinations

Blood smears were prepared from fresh whole blood on microscope glass slides (75mm by 25mm), air dried, fixed in methanol and stained with Giemsa's stain while blood films were prepared to examine trypanosomes and microfilaria according to Soulsby (1982). Haemoparasites were identified by direct microscopic examination using X40 and X100 oil immersion objectives of a compound microscope (Olympus, USA), based on morphologic keys described by Soulsby (1982).

d) Haematological Examinations

The blood samples were analyzed for hemoglobin (Hb) by acid hematin (Sahli's) method, packed cell volume (PCV) by microhaematocrit, and total red blood cell (RBC) and total white blood cell (WBC) counts by Neubauer hemocytometer (Brar *et al.*, 2000). The erythrocyte indices (mean corpuscular volume, MCV; Mean Corpuscular Hemoglobin, MCH; and Mean Corpuscular Hemoglobin Concentration, MCHC) were calculated using standard formula (Jain, 1998).

e) Statistical Analysis

Prevalence was calculated as $P (\%) = d/n$ where P= prevalence, d= number infected and n= number examined (Thrusfield, 2005), and the 95% confidence intervals on prevalence was calculated using Vassar Stats® statistical computation web site. The student t-test was used to compare the haematological parameters of infected and uninfected camels and $p < 0.05$ was considered significant.

III. RESULTS

Overall prevalence of haemoparasites and their 95% confidence intervals (CI) in the one humped camel (*Camelus dromedarius*) slaughtered in Maiduguri is presented in Table 1. Out of 209 blood films and smears examined, 27 (12.4%) were positive for various types of haemoparasites. Young (19.4%) and male (20.8%) camels had insignificantly higher ($p > 0.05$) prevalence than the adult (11.8%) and female (11.9%) counterparts.

The 4 types of haemoparasites identified in blood films and stained blood smears of the one humped camels (*Camelus dromedarius*) slaughtered in Maiduguri is shown in Table 2. A total of 3 genera of haemoprotozoa including *Anaplasma* (37.7%), *Babesia* (22.2%) and *Trypanosoma* (33.3%), in addition to *microfilariae* of nematode, *Dipetalonema* (7.5%) were detected.

Mean values of haematological parameters of the infected and uninfected one humped camel (*Camelus dromedarius*) slaughtered in Maiduguri is shown in Figure 1. All the haematological parameters of the infected and uninfected camels examined in this study were within range of normal values. However, the mean values of RBC in the infected and uninfected camels examined in this study were significantly different ($p < 0.05$) but the mean values of PCV, Hb, WBC, MCV, MCH and MCHC of infected and uninfected slaughtered camels were comparable ($p > 0.05$).

IV. DISCUSSION

The prevalence of haemoparasites in slaughtered trade camels in Maiduguri has progressively increased in the last two decades. Egbe-Nwiyi and Chaudhry (1994) reported 2.5% prevalence, Bamaiyi *et al.* (2011) reported 5.7% prevalence while the current study recorded an overall prevalence of 12.9%. The observed increase in prevalence of haemoparasites in this locality could be attributed to preponderance of arthropod vectors due to favorable micro climatic conditions in the region (Biu and Konto, 2011). Also, previous reports on prevalence of haemoparasites in other species of domestic animals in different parts of the country suggests that haemoparasitism is endemic in Nigeria. Biu *et al.* (2005) reported an overall prevalence of 17.3% in cattle from Maiduguri. Ameen *et al.* (2008) reported a total prevalence of 4.1% in ruminants from Oyo state. Okeyeto *et al.* (2008) reported a total prevalence of 13% for various species of haemoparasites in pastoral sheep from Kaduna state. Shamaki *et al.* (2009) reported a prevalence of 9.1% for *Trypanosoma* species in cattle from Gombe state. Furthermore, Ademola and Onyiche (2013) reported a prevalence of 5% in ruminants from Ibadan. These reports further validate our findings and suggest that the various species of haemoparasites constantly circulates among different species of domesticated and semi-domesticated animals in Nigeria, with some semi-domesticated species probably serving as permanent reservoir of infection. The role of arthropod vectors in transmission of haemoparasites has been described (Soulsby, 1982; Urquhart *et al.*, 1996), and the transhumant conditions under which camels are traditionally raised in the tropics exposes them to the arthropod vectors of haemoparasites.

The higher prevalence of haemoparasites recorded in younger camels in this study agrees with previous report by El-Naga and Barghesh (2016). Similarly, Ademola and Onyiche (2013) also reported an inverse age related decrease in prevalence of haemoparasites in slaughtered animals in Nigeria. The higher prevalence of haemoparasites recorded in male than female camels in this study is in agreement with Ahmed and Bringa (2014) but disagrees with El-Naga and Barghash (2016) who reported a higher prevalence of haemoparasites in female than male camels. Also, Shamaki *et al.* (2009) reported a higher prevalence of haemoparasites in female donkeys, sheep and cattle than their male counterparts. Generally, male animals under the extensive system of management in which camels are traditionally raised have high natural tendencies of acquiring diseases than the females because they tend to move about in search of mates for courtship and breeding purposes.

All the 3 genera of haemoprotozoa identified in this study were previously reported in camels (Egbe-Nwiyi and Chaudhry, 1994; Bamaiyi *et al.* 2011) and domestic animals in Nigeria (Abenga *et al.*, 2004; Biu *et al.*, 2005; Kamani *et al.*, 2010; Ademola and Onyiche, 2013; Okorafor and Nzeako, 2014; Qadeer *et al.*, 2015) and elsewhere in the world (Soulsby, 1982; Alonso *et al.* 1992). The high frequency of *Anaplasma* species in this study may be due to the abundance of suitable environmental conditions that favours multiplication and survival of the arthropod vectors (Soulsby, 1982; Shah-Fischer and Say, 1989). Similarly, the high prevalence of *Trypanosomes* in the present study may be linked to the abundance of biting flies such as *Stomoxys*, *Tabanus* and *Hippoboscids* in the region (Agbede, 2013), and the transhumant conditions under which camels are reared may increase their exposure to the arthropod vectors. Previously, few cases of trypanosomosis have been reported in camels from Maiduguri (Egbe-Nwiyi and Chaudhry, 1994). These occurrences were linked to the movement of camels through tsetse infested to tsetse free zone as they travel down towards the northern limit of tsetse distribution in Borno state. Moreover, mechanical vectors such as biting flies which have been incriminated in transmission of trypanosomosis in tsetse free zones (Soulsby, 1982) are abundant in Maiduguri and environs, and could play a significant role in transmission. The occurrence of *Dipetalonema* species *Microfilaria* in camels in this study never reported in Maiduguri and the low prevalence rate indicate that filariid nematodes are erratic in the geographical region due to unavailability of suitable ecological conditions for propagation of *Simulium* species which serve as their natural vector (Soulsby, 1982). Moreover, Mosquitoes are known to play a significant role in transmission of microfilaria (Soulsby, 1982).

The mean values of RBC, PCV, Hb, WBC, MCV and MCH were within normal range of values in desert camels (Farooq *et al.*, 2011) but the MCHC was below normal range. Moreover, mean values of most haematological parameters of infected and uninfected slaughtered camels examined in this study were comparable ($p > 0.05$). The absence of anemia, which is a reliable indicator of severity in haemoparasitic infections (Adejinmi *et al.*, 2004) may be due to the fact that infected camels were probably carriers with latent infection. In the presence of favourable immunity and good nutrition, there may be adequate compensatory haematopoietic response in the course of most haemoparasitic infections, which could mask the initial anemia, hence the observed normal haemogram in this study. The significantly ($p < 0.05$) higher mean RBC counts observed in infected camels than uninfected ones may be explained on the basis of active haematological response to the presence of haemoparasites, which usually occurs in the course of natural infections (Soulsby, 1982).

V. CONCLUSION

This study reports endemic proportion of haemoparasites and the first occurrence of microfilaria of *Dipetalonema* species in one humped camel in Maiduguri. The results obtained from this study also indicate that camels in Maiduguri may harbor subclinical infections involving various genera of haemoparasites. The role of camels as carriers and or reservoirs for other species of domestic animals is suspected since infection is not associated with significant changes in haematological parameters.

VI. RECOMMENDATION

We recommended the need for further studies using molecular methods to elucidate the various species of haemoparasites circulating in camels within the region. Also trade camels coming to Maiduguri for slaughter or other purposes should be screened for and be treated against haemoparasites. There is an immediate need to educate camel herders in this locality on preventive chemoprophylaxis and vector control using effective insecticides, acaricides and environmental management as well as chemotherapeutic control measures.

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Conflict of Interest

The authors did not declare any conflict of interest concerning this work.

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Table 1 : Overall Prevalence of Haemoparasites and their 95% CI in the one Humped Camel (*Camelus dromedarius*) Slaughtered in Maiduguri Abattoir.

Variables	No. Examined	No. Positive (%)	95% CI	
			L	U
Age				
Young	31	6 (19.4)	0.09	0.36
Adult	178	21 (11.8)	0.08	0.17
Sex				
Male	24	5 (20.8)	0.09	0.21
Female	185	22 (11.9)	0.08	0.17
Total	209	27 (12.9)	0.09	0.18

CI= 95% confidence interval on prevalence, L= lower limit, U= upper limit

Table 2 : Types of Haemoparasites identified in the one Humped Camel (*Camelus dromedarius*) Slaughtered in Maiduguri Abattoir.

Haemoparasites	No. Positive (%)
Anaplasma	10 (37.0)
Babesia	6 (22.2)
Microfilaria	2 (7.4)
Trypanosoma	9 (33.3)
Total	27 (12.9)

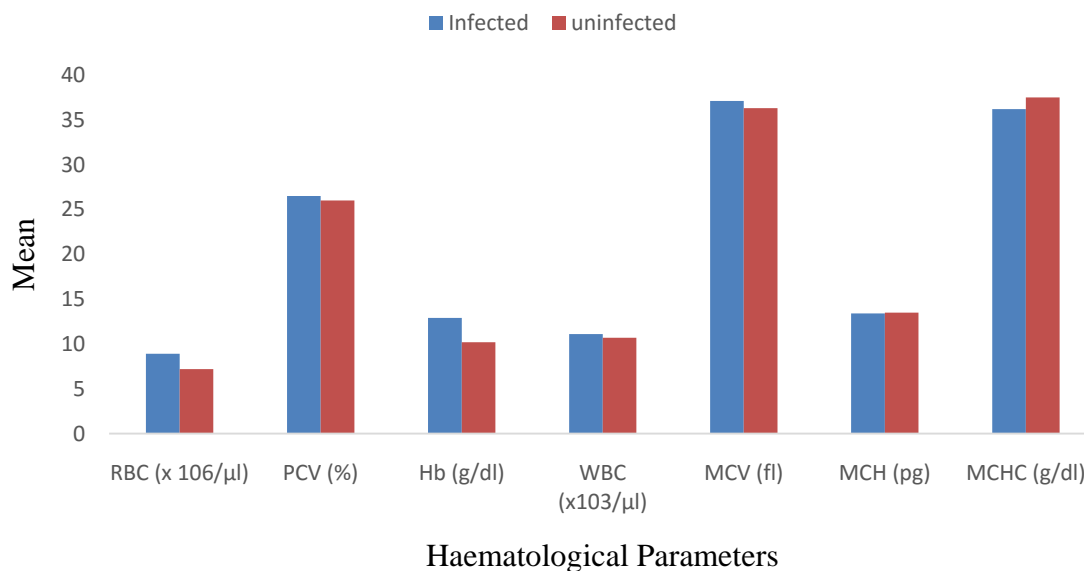


Figure 1 : Mean values of Some Haematological Parameters of Infected and Uninfected one Humped Camel (*Camelus dromedarius*) Slaughtered in Maiduguri Abattoir.