

Survey on Prevalence of Haemoparasites in Sahel Goats from Maiduguri, Nigeria

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Abstract

This study was carried out between the months of February and August 2014, to investigate the prevalence of blood parasites from Sahel goat reared by Fulani herdsmen pastoralists in Maiduguri, Borno State, Nigeria. Giemsa stained thin blood films of 119 Sahel goats of both sexes were microscopically examined in this study for the presence of haemoparasites and a total of 16 (13.44%) goats were found to be infected with *Anaplasma* spp. 11 (9.24%), *Babesia* spp. 2 (1.68%) and *Theileria* spp. 3 (2.52%). The prevalence was found to be higher in young 7.56% (9) Sahel goats than in the adults 5.88% (7) with no statistical significant difference (P -value= 0.098) between infection rate and ages of goats. Moreover, the infection rate was apparently higher in females 15.94% (11) than in the male 10.0% (5) Sahel goats sampled statistical significant difference (P -value= 0.589). Prevalence rate was significantly (P -value= 0.040) higher in emaciated 12.16% (15) than in the normal 0.84% (1) flesh Sahel goats. Packed cell volume (PCV) (29.26 ± 4.2) and haemoglobin concentration (Hb) (9.62 ± 1.3) of normal goats were significantly higher compared with infected goats 21.31 ± 2.9 and 7.09 ± 1.0 respectively ($P < 0.05$). This study unveiled the occurrence of negative effect of haemoparasites in Sahel goats in the study area. Therefore, there should be routine screening to reduce the pathophysiological effect of the parasites as well as putting in place strategic measures to control the vectors involved in the disease transmission.

Keywords: Prevalence; *Anaplasma* spp.; *Babesia* spp.; *Theileria* spp.; Sahel Goats; Maiduguri; Nigeria

Introduction

Livestock production system has been considered an important activity towards sustaining human development through the provision of food, employment and maintaining national economy [1]. Ruminants comprising sheep, goats and cattle constitute one of the common livestock reared in Nigeria [2]. Their population has recently been estimated to about 22.1 million sheep, 34.5 million goats and 13.9 million cattle [2]. The sheep and goats also classified as the small ruminants plays an important socioeconomic role within traditional animal husbandry systems [3,4]. They contribute significantly to the meat, milk, skin production and the socio-cultural values which account for about 35% of the capital values of Nigerian Livestock industry [5]. Goats have been found to contribute significantly to the livelihood of most low income earners in Nigeria, mainly for the provision of animal protein and income [3]. The breeds of goats in Nigeria are largely indigenous breeds which include the West African Dwarf (WAD) goat, Sahel/desert

goat also known as West African Long-Legged goat; and Sokoto Red/Maradi [6]. However, the West African Dwarf (WAD) goats are more predominant in the south while the Sokoto red//Maradi and Sahel//desert goats is more largely found in the north [7].

One of the most important constraint of small and large scale goats production is the high prevalence of infectious diseases as well as a wide variety of parasites including blood sucking arthropod transmitted eukaryotic blood parasites [8-11], which has been reported as major constraint, causing high morbidities and mortalities and preventing the animals to express their full genetic potential [12-14]. Amongst the haemoparasitic infections, trypanosomosis, babesiosis and anaplasmosis are considered as major impediments to ruminant production [15,16]. These diseases have been reported to cause severe destruction of red blood cells resulting in anaemia, high morbidity and mortality as well as infertility, jaundice and weight loss [18-19]. Anaemia has been considered as a reliable marker for the severity of haemoparasitic infec-

tions in goats [20]. Several studies have reported the prevalence of anaplasmosis, trypanosomosis, babesiosis and theileriosis from various breeds of goats in developing countries including Nigeria [1,4,11,21-25]. Even though there several published reports on the incidence of haemoparasites infections in developing countries of Africa, the diseases still remains one of the major challenge to livestock production in sub-Saharan Africa [9,10]. *Trypanosoma*, *Babesia*, *Anaplasma*, *Ehrlichia* and to a less extent *Theileria* are considered as the most economically important genera of these haemoparasites [26,27]. Farmers may not be ignorant of the effects of these haemoparasites on their animals' health, probably due to the subclinical nature of presentation and chronic nature of the diseases on the affected animals [11] as it is in gastrointestinal parasitism [28].

Proper understanding of the epidemiology of disease causing agents is a prerequisite for the rational design of effective preventive and control programme against the disease. Several studies in respect to epidemiology of haemoparasites and their effects on haematological parameters in ruminants in some parts of Nigeria have been confined to the various breeds of cattle or sheep. There has been paucity of information on the prevalence of haemoparasites in Sahel goats in Nigeria. This present study targeted at providing relevant information in this regard because the Sahel goats are predominant among the breed of goats reared in Maiduguri. Therefore, this present study was designed to elucidate the prevalence of haemoparasites and its effects on some haematological parameters in Sahel goats in Maiduguri, Nigeria.

Materials and Methods

Study area

The present study was conducted in Maiduguri, the capital of Borno State, North Eastern Nigeria. It is located in the Arid Zone with an area of about 69,436km² and lies within latitude 10^o -13^o N and longitude 12^o- 15^o E. It lies within the Sahel Savannah Zone with low records of rainfall. The area falls in the tropical continental North with dry Months between 4 and 8 Months (October - May) followed by a short rainy season from late June to early October. The State has a boundary with Chad republic to the North East, and Cameroun republic to the East.

Sample collection

Blood samples were collected randomly from the jugular veins of 119 apparently healthy Sahel breed of goats of both sexes and various age groups in the study area. From each sampled goat was manually restraint, 3-5ml of blood was aseptically collected from the jugular vein into well labeled Ethylene Diamine Tetra Acetate (EDTA) anticoagulant bottles which were placed gentle in ice pack for onward transportation to the Department of Veterinary Parasitology and Entomology research laboratory, University of Maiduguri for processing and examination. Parameters such as the sex, age and body condition score of each sampled goat was evaluated and were recorded accordingly.

Sample preparation, staining procedure and microscopy for haemoparasites

Thin blood smears were made from each blood sample and processed according to the method previously described by Hansen and Perry [29], Cheesbrough [30] and Gupta and Singla [31]. The smears were later examined under the light microscope at x100 objective magnification (oil immersion) for presence or absence of haemoparasites as described by Mosqueda, *et al.* [32]. Parasites were identified using the key standard characteristics of the parasites described by Soulsby [33] and Brar., *et al.* [34].

Packed Cell Volume (PCV) determination

Whole blood samples were carried in cold packs to the haematology unit of the Department of Veterinary Pathology where Packed Cell Volume (PCV) of each blood sample was determined according to standard procedure previously described by Hansen and Perry [29] and Urquhart., *et al.* [35].

Haemoglobin count (Hb) determination

Haemoglobin concentration estimation was carried out by application of the Acid Hematin method using Sahli's instruments as described by Brar., *et al.* [34].

Age, sex and body condition score determination

The age of each sampled goat was estimated by dentition as described by Hassan and Nwannenna [36], while sex differentiation was made based on the appearance of external genitalia and presence or absence of testis and udder. Each sampled goat was scored based on estimated condition of muscling and fat development as described by Thompson and Meyer [37]. Using the scale of 1 to 5 which is represented as follows; Condition 1 = Emaciated; Condition 2 = Thin; Condition 3 = Average or Normal; Condition 4 = Fat and Condition 5 = Obese.

Data analysis

All the data generated from this study were subjected to several descriptive statistical analysis and the prevalence was expressed in percentage. One-Way analysis of variance (ANOVA) using Microsoft Excel® Analysis ToolPak (Microsoft Office, 2007) to evaluate possible significant differences ($p < 0.05$) between non-infected and infected animals. Chi-square students' t test were also used to test for association between the age and sex of goat. Pearson correlation was also used to test for relationship between PCV and Hb. P values < 0.05 were considered significant. GraphPad prism version 4.0 Windows from Graphpad Software, San Diego, California USA was used to analyze the data.

Results

Out of 119 Sahel goats examined in this present study, a total of 16 (13.44%) goats were found to be infected with haemoparasites (Table 1). The prevalence of infection comprised of *Anaplasma* spp. 11 (9.24%), *Babesia* spp. 3 (2.52%) and *Theileria* spp. 2 (1.68%).

Haemoparasites encountered	Number of infected animals (N= 119)	Prevalence rate (%)
<i>Anaplasma</i> spp.	11	9.24
<i>Babesia</i> spp.	3	2.52
<i>Theileria</i> spp.	2	1.68
Total	16	13.44

Table 1: Prevalence of haemoparasites in Sahel goats in Maiduguri, Nigeria.

N = Total number of Sahel goats examined.

The age-specific and age-specific prevalence of haemoparasites in Sahel goats as well as the body condition scoring is presented in Table 2. The haemoparasitic infection rate was found to be higher in young 7.56% (9) Sahel goats than in the adults 5.88% (7) goats. There was no statistical significant difference (*P*-value = 0.098) between haemoparasitic infection rate and ages groups of goats. Moreover, the infection rate of haemoparasites encountered was apparently higher in females (15.94%) than in the male (10.0%) Sahel goats sampled with no statistical significant difference (*P*-value = 0.589) between haemoparasitic infection rate and sexes of goats. The infection rate was statistical significantly (*P*-value = 0.040) higher in emaciated (12.16%) than in the normal (0.84%) flesh Sahel goats.

Risk factors	Parameters	No. of goats examined	No. of goats infected	Prevalence (%)	95% CI L - U		P-value
					Lower limit	Upper limit	
Age (months)	Young (3 - 6)	40	9	7.56	0.0403	0.1375	<i>P</i> -value = 0.0982
	Adult (7 - above)	79	7	5.88	0.0288	0.1164	
Sex	Male	50	5	4.20	0.0181	0.0946	<i>P</i> -value = 0.5891
	Female	69	11	9.24	0.0524	0.1579	
Body condition	Normal	37	1	0.84	0.0015	0.0461	<i>P</i> -value = 0.0404
	Emaciated	82	15	12.61	0.0779	0.1976	

Table 2: Prevalence of haemoparasites in Sahel goats on the basis of age, sex and body condition scores.

The result of mean ± SD (range) of some haematological parameters viz: Packed cell volume (PCV) and haemoglobin concentration (Hb) of normal and infected Sahel goats examined were shown in Table 3. Normal goats had a significantly higher mean ± SD (range) for PCV and Hb of 29.26 ± 4.2 and 9.62 ± 1.3 compared to the haemoparasitic infected Sahel goats 21.31 ± 2.9 and 7.09 ± 1.0 respectively (*P*<0.05).

Haematological values	Non infected goats	Infected with haemoparasites
Packed cell volume (PCV %)	29.26 ± 4.2	21.31 ± 2.9*
Haemoglobin conc. (g/dl)	9.62 ± 1.3	7.09 ± 1.0*

Table 3: PCV (%) and Hb (g/dl) of normal and haemoparasites infected Sahel goats in Maiduguri, Nigeria, Mean ± SD (Range).

**P*<0.05 compared to mean values of uninfected group of examined animals.

Discussion

Haemoparasitic infections is considered a major threat to livestock production systems in tropical and sub-tropical regions of developing countries of the world especially in camels, cattle, sheep and goats [18,27,38-40]. The present study revealed 13.44% overall prevalence rate of haemoparasitic infections in Sahel goats which was relatively lower than 14.30% reported in Sahel

goats by Opara, *et al.* [41] in Lafia Nigeria. Amongst the haemoparasites observed in the infected goats, *Anaplasma* spp. had the highest prevalence rate of 9.24% while the prevalence of *Babesia* spp. and *Theileria* spp. were 2.52% and 1.28% respectively. This finding supported those of Jatau, *et al.* [11] who in a similar study reported *Anaplasma* spp. (11.34%), *Babesia* spp. (2.06%) and *Theileria* spp. (4.12%) from goats in Kano State as well as Anyanwu, *et al.* [1] who have also reported *Anaplasma* spp. (20.70%), *Babesia* spp. (13.40%) and (2.81%) *Theileria* spp. from goats in Nassarawa State, Nigeria with varying prevalence rates. However, the finding of this present study coincided with those of Jatau, *et al.* [11]; Onaja, *et al.* (2013) and Opara, *et al.* [41] who reported high prevalence of *Anaplasma* spp. compared to other haemoparasites genera in goats from Kano, Zaria and Lafia Nigeria respectively. But, the finding of the present study is contradictory to the report of Ukwueze and Kalu [4] who reported higher prevalence of *Babesia* spp. (28.80%) against *Anaplasma* spp. (16.80%) in goats from Umuhia, Abia State, Nigeria. The finding of *Babesia* spp. (2.52%) and *Theileria* spp. (1.68%) in the present study is not surprising; infections with these arthropod borne haemoparasites is likely to occur due to the common mixed livestock extensive grazing system practiced by the ruminant pastoralists, where the Sahel goats are usually grazed with other ruminants, which could possibly create opportunities for cross mechanical transmission of diseases amongst different species of ruminants during grazing especially where vectors such as the ticks are abundantly present. This observation buttresses similar suggestion by Useh, *et al.* [15] who reported vari-

ous species of haemoparasites in goats reared extensively in Zaria Nigeria. From this present study, the relatively low prevalence of *Babesia* spp. could be attributed to the fact that animals that recovered from babesiosis become immune to re-infection [5]. Small ruminants such as the goats have been reported to be endemically unstable for *Babesia* spp. parasite [11]. In this present study, trypanosomes were not recorded; this could signify absence of *Glossina* species in the study area. The finding of this present study is contradictory to Ohaeri (2010); Ukwueze and Kalu [4], Josiah, *et al.* [42] and Opara, *et al.* [41] who have reported a low prevalence rates of 1.20, 1.60, 0.50 and 1.90% in goats from Umuahia, Abia, Kogi and Lafia in Nigeria respectively as well as Anyaebunam and Okafor [3] who found a higher prevalence of 14.1% trypanosomes from goats in Nsukka Nigeria. None trypanosomes prevalence recorded in Sahel goats in the present study could be attributed to lower vector abundance with low infection rates in the zone as reported by Ohaeri [43] and Ohaeri and Eluwa [44] and Nwoha, *et al.* [45]. Moreover, small ruminants are not natural hosts for the mechanically transmitted trypanosomosis.

The finding of this present study revealed lower prevalence of haemoparasitosis in adult (7 and above months old) Sahel goats (5.88%) compared to the younger (3 to 6 months old) ones. It is assumed that adult goats may have developed immunity to infections due to previous series of infections with haemoparasites. This finding is contradictory to those of Opara, *et al.* [41] who reported low level of haemoparasites infection rate in young goats (11.5%) compared to the adults (30.4%). However, in the present study there was no statistical significant difference (P -value= 0.098) which signifies equal chances of getting infection when equally exposed to the vectors of these haemoparasites.

The prevalence of haemoparasitic infection according to sexes of the Sahel goats examined in the present study revealed that more females (15.94%) than males (10.0%) are infected by these haemoparasites. Although, the difference is not statistically significant (P -value=0.589). This result supported previous study of Abenga, *et al.* [46], who also reported a prevalence of 2.27% rate in females as against 1.60% in males. But, the seeming high prevalence of haemoparasitic infections in females than in the Males could be attributed to the proportion of the female Sahel goats population sampled. This corroborates the findings of Samdi, *et al.* [47], Nwoha, *et al.* [45], Ademola and Onyiche [18] and Ukwueze and Kalu [4] who have also reported more frequent occurrence of haemoparasites in female ruminants compared to their males. Moreover, most of the ruminant pastoralists keep large number of females than males especially for breeding purposes which are assumed to affect the proportion of the sex infected. It has been reported that the female ruminants are generally more prone to infection by haemoparasites due to their extended breeding for economic purposes such as parturition and milk production [4,18] as well as the stress of breeding, milking and cyclical hormonal changes associated with gestation, parturition and calving processes. However, the result of the present study is contradictory to previous findings of Opara,

et al. [41] who reported higher prevalence of haemoparasites in males (27.70%) than in the female goats (16.0%) as well as Anyanwu, *et al.* [1] who also reported high prevalence in males (23.77%) goats compared to the females (19.62%).

The finding of the present study revealed higher infection rate of haemoparasites in emaciated Sahel goats with poor body condition compared to those in good flesh. Progressive emaciation in ruminants in most cases might be due to physiological wasting away or poor nutrition. Poor nutrition lowers the resistance of the animals to infectious diseases, thus enhancing the establishment of haemoparasitaemia and increasing the pathogenicity of the parasites. It is well known that adequately fed animals are more able to tolerate parasitism than animals on a low plane of nutrition [48,49]. Moreover, haemoparasitaemic animals are reported to be anaemic, emaciated with poor performances and decrease in milk and meat production [50,51]. The present study demonstrated a statistical significant difference (P -value= 0.0404) between haemoparasitaemia and body condition score. This means that as haemoparasites increased in the blood the infected animal continues to emaciate vice versa. This finding is in line with the report of Okaiyeto, *et al.* (2008).

The finding of the present study revealed significant decreases in the packed cell volume and the haemoglobin concentration of infected Sahel goats sampled compared to the uninfected ones. Decrease in PCV and its corresponding drop in haemoglobin concentration as against the normal range in ruminants signify anaemia and physiological lose of blood proteins in the infected animals. The effects of haemolytic activities of the haemoparasites might be the cause of anaemia in the infected Sahel goats. Anaemia in the infected goats may be as a result of haemolysis of red blood cell, and haemoparasites have been reported to be capable of inducing erythrocytolysis and erythrophagocytosis. Moreover, goats are considered anaemic when their mean PCV value is below 22% and dehydrated when it is above 38% [52]. However, the Sahel goats with haemoparasitaemia sampled in this study were considered anaemic because their mean PCV is 21.31% and their mean Hb concentration is 7.09g/dl. The anaemia observed on infected animals suggests that the haemoparasitic infection may be the cause of anaemia. Anaemia has been reported as the major clinical sign in the haemoparasitic diseases affected animals. This finding is in agreement with Okaiyeto, *et al.* [10]; Anumol, *et al.* [53]; Nwoha, *et al.* [45]; Okorafor and Nzeako [26]; Ukwueze and Kalu [4]; Josiah, *et al.* [11]; Anyanwu, *et al.* [1]; Opara, *et al.* [41] who have also reported anaemia as a reliable indicator for the severity of haemoparasitic infections in small ruminants.

Conclusion

The result of this study clearly indicates that haemoparasitic infections were common in Sahel goats reared by the Fulani pastoralist during the study period in Maiduguri, Borno State. It revealed the existence of possible negative effect of the haemoparasites in

blood of the Sahel goats infected in the study area. Therefore, there is need for prevention and control programs against these parasites, which call for routine screening to reduce the pathophysiological effect of the parasites and strategic measures should be taken to control the vectors involved in their transmission. When these are adequately carried out it will improve the production potentials of these breed of small ruminants.

Therefore, there is need for prevention and control programs against these parasites goats in endemic areas. This when carried out will improve the production potentials of these animals and the economic well-being of the owners.

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