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Prevalence, Haematology and Risk Factors Associated with Haemoparasites Infections of Small Ruminants Reared in Makurdi, Nigeria

Ogbaje, I. C.[1]*; Mandabsu, E. S.[1] and Obijiaku, I. N.[2]

[1]. Department of Veterinary Parasitology and Entomology, College of Veterinary Medicine, University of Agriculture, Makurdi, Nigeria. [2]. Department of Public Health and Preventative Medicine, College of Veterinary Medicine, University of Agriculture, Makurdi, Nigeria. *Corresponding author: Email: igochechriso@yahoo.co.uk; Tel No:+2348035295570.

SUMMARY

A survey of haemoparasites, haematology and risk factors associated with haemoparasitic infections of small ruminants was conducted in Makurdi between September-December, 2016. A total of 200 sheep and goats comprising of 96 sheep and 104 goats were screened for haemoparasites. A total of 72 (75%) sheep and 71(68%) goats were found positive of either single or mixed infections. *Anaplasma* spp (69.79% and 61.53%) was found to be the most prevalent in both animals, followed by *Babesia* spp (11.46% and 0.96%) in goats and sheep respectively. *Trypanosoma* spp was 1.04% in both sheep and goats. The only mixed infections encountered was *Anaplasma* spp and *Babesia* spp in both animals, goats (3.13%) and sheep (1.92%). The prevalence based on sampled location in the sheep and goats were; Mission ward/ katungu,75.81% and 69.54%, Agan ward, 77.27% and 75%, Wurukum, 0% and 33.33%, University Community, 100% and 81.82% and Wadata, 60% and 0% respectively. In relation to sex, for sheep; male 16(76.19%), female 56(74.66%), goats, male 25(68.42%) and female 46(69.70%) and based on age, infected young and adult for sheep were 10(66.67%) and 62(76.54%) while goats were 7(50%) and 64(71.11%) respectively. Prevalence based on breed: for sheep, Yankasa 76.06%, WAD 76.47%, Uda 57.14% and Balami 100% and for goats; WAD 65.30%, Red Sokoto75.86%. There were no statistical differences between the haematology of the infected and non-infected animals. The results of this study clearly revealed that haemoparasite infections is common among small ruminants in Makurdi, and age, sex, breed and location are not risk factors for the diseases. This requires further investigation in the areas of transmission, to establish the genus and species of ticks and other arthropods vectors responsible for the wide spread infections.

Key words: Small ruminants, Haemoparasites, Risk factor, Haematology, Prevalence.

INTRODUCTION

Livestock production is the most important agricultural activity in most of the countries in the tropical and sub-tropical regions where production vary from sophisticated

commercial to communal subsistence types (Webb *et al*.,2004). The overall population of goats and sheep has been estimated to be about 1,028 million and 765 millionare in tropical Africa and these are about 17% and 22% of the total world goats and sheep population respectively (Ahmed and Egwu, 2014). Nigeria is a home to about 22.1 million sheep with approximately 3.4 million located in the southern/humid region and the other larger proportion are found in the Northern part of the country and 26 million goats, with an estimate of about 6.6 million located in the southern part of Nigeria and 20 million in the northern part (Ahmed and Egwu, 2014; Ukwueze and Kalu, 2015). About 70% of the small ruminants are found in the semi-arid zones of Nigeria and these belong to the agro-pastoral farmers that utilize extensive and semi-intensive management systems (Webb *et al*., 2004). Majority of the sheep population in Nigeria are owned by small-holder rural livestock farmers with few in the urban areas (Webb *et al.,* 2004).

The role of small ruminants in the traditional areas has been recognized; sheep and goats, like cattle, play an important role in the livelihood of rural people in communal farming systems where most of the goats are the indigenous types (Webb *et al.,* 2004). It has been reported that, indigenous goats constitute a valuable genetic resource because of their ability to adapt to the harsh climatic conditions and better utilization of the limited and often poor quality feed resources and their natural resistance to wide range of diseases (Bayer, 1984). Sheep contribute enormously to the protein requirements of most developing countries such that in Sub- Saharan Africa, it provide almost 30% and about 16% of the meat and milk consumed respectively (Maigandi *et al.,* 2010).

In Nigeria, it has been estimated that small ruminants contribute about 35% of the total animal protein consumed (Ahmed and Egwu, 2014). This ranks small ruminants as second to cattle as the most important suppliers of meat to the entire country population (Maigandi *et al.,* 2010; Ahmed and Egwu, 2014). Small ruminants farming is an important and secured form of agricultural investment to the Nigerian rural and urban farmers as it account for about 56% of some small holder farmer's income (Adeshinwa *et al*., 2004).

Despite the enormous contributions of the small holder farmers to the Nigerian's livestock economy and development and in spite of the special attributes possessed by small ruminants, such as their high prolificacy, low input for high return and their early maturity, the productivity potential of these animals is still yet to be fully tapped (Maigandi *et al*., 2010).

Haemoparasitic diseases of sheep and goat are one of the limiting factors hindering the optimal productivity of small ruminants and the diseases have a global distribution, stretching from the polar circle to the equator because of the wider distribution of their vectors (ticks and blood sucking flies), (Ademola and Onyiche, 2013; Yiytayew and Dersos, 2015). Generally, haemoparasites of livestock reduce their productivity and may even lead to high mortality. Parasitic diseases have debilitating impact on both human and animal health worldwide particularly in developing countries (Ademola and Onychie, 2013). Proper understanding of the epidemiology of these diseases is a prerequisite to a rational design for the effective control and preventive strategies against these dreadful diseases (Opara *et al.*, 2016). The most important and frequently found haemoparasitic diseases of small ruminants in the tropic and sub-tropic include; babesiosis, theileriosis, anaplasmosis and trypanosomosis. Haemoparasitic diseases of sheep and goat are important globally because of their wider vectors distribution and their serious economic impact (Yiytayew *et al*., 2015).

This work was conducted to ascertain the current status, haematology and some of the risk factors (breed, sex, age, management system, environment etc.) associated with

haemoparasitic infections of small ruminants in the study area because of the scanty information about the diseases in the study area.

MATERIAL AND METHODS

Study area

The study was conducted in Makurdi, Capital of Benue State. The city is located in northern central of Nigeria along the Benue River. Makurdi had an estimated population of 300,377 (NPC, 2006). Makurdi Metropolis lies on the geographical coordinates of Latitude 7^0 43' 50'' N, and longitude 8^0 32' 10'' E (Echi *et al.,* 2013). The climate of the area is tropical vegetation in nature and is predominantly guinea savannah with annual average rain fall of 1,290mm. There are two distinct season, the rainy season (April – October) and dry season, (November – March). The average temperature ranges between 22.5^0C- 40^0C (Temi and Tor, 2006).

Sample collection

The samples were collected from five different locations; Wadata, Wurukum, Mission Ward-North bank, Agan, along Lafia road and University of Agriculture, Makurdi community. Two hundred (200) blood samples were collected from sheep and goats of all ages and both sexes. Ninety-six 96 sheep of different breeds (Yankasa, WAD, Uda, and Balami) and one hundred and four (104) goats (WAD and Red Sokoto) were sampled. The sample size was determined from previous prevalence of 15.3% (Opara *et al*., 2016). Approximately 2ml of blood was collected from each animal through the jugular vein and dispensed into sample bottle containing Ethylene Diamine Tetra Acetic Acid (EDTA) as anticoagulant and transported in ice packed to Department of Veterinary Parasitology and Entomology Laboratory of the College of Veterinary Medicine, University of Agriculture, Makurdi for parasitological and haematological analyses within an hour of collection.

Sample analysis

All the samples were subjected to wet mount examination within 60 minutes of collection to check for motile parasites such as trypanosomes and microfilariae.

Thin blood smear was performed as described by Hendrix and Robinson, (1998). The smears were allowed to dry and later examined under light microscope (×100 magnification/oil immersion).

Packed Cell Volume (PCV) was determined for each animal sampled by haematocrit centrifuge technique as described by Cole, (1986) after which buffy coat technique was carried out on the samples**.** Serum plasma protein concentration was also estimated using Goldberg Refractometer according to Kerr, (1989) and the total and differential white blood cell counts were determined using standard methods by Schalm *et al*. (1975).

Data analysis

The data generated from the study were subjected to Graph pad-prism, Chi-square, Student's t-test, Excel and descriptive statistical method. Value greater than 0.05 ($P \geq 0.05$) is not statistically significant.

RESULTS

Out of 96 sheep and 104 goats examined, 72 (75%) and 71(68%) were infected with either single or mixed infections respectively (tables 1 and 2). The overall prevalence in both animals is 71.5%. Prevalence based on type of haemoparasites in both sheep and goats is shown in table 3. The most prevalent haemoparasite in both animals is *Anaplasma* spp; 69.79% in sheep and 61.53% in goats respectively. This is followed by *Babesia* spp, sheep (11.46%) and goats (0.96%) respectively as shown in table 3. *Trypanosoma* and *theileria* spp recorded 1.04% prevalence each, in sheep and 0% prevalence in goats. The only mixed

TABLE 1: Prevalence of haemoparasites in small ruminants in Makurdi

Specie	Number Examined	Positive	Prevalence (%)	Chi Square	P- Value	Odds Ratio
Sheep	96	72	75	13.72	0.0002	
Goats	104	71	68.27			0.13

TABLE 2: Single and mixed haemoparasite infections in small ruminants in Makurdi

Specie	Infection	Number Examined	Positive	Prevalence (%)	Chi Square	P-Value	Odds Ratio
Sheep	Single	96	89	92.70	96.80	0.0001	79.22
	Mixed	96	3	3.13			
Goats	Single	104	69	66.35		0.0001	100.50
	Mixed	104	2	1.92	95.99		

TABLE 3: Prevalence of different genera of haemoparasites in sheep and goats in Makurdi

Haemoparasite	Number Examined	Positive	Prevalence (%)	Chi Square	P-Value	Odds Ratio
Sheep		11	11.46			
Babesia		67	69.79			
Anaplasma		1	1.04			0.06
Trypanosoma	96	1	1.04			12.29
Theileria				236.20	0.0001	12.29
Mixed Infection (B/A)		3	3.13			4.01
Goats						
Babesia		1	0.96			
Anaplasma		64	61.53			0.006
Trypanosoma		0	0			3.029
Theileria	104	0	0	274.40	0.0001	3.029
Mixed Infection (B/A)		2	1.92			0.49

(B/A)= *Babesia* and *Anaplasma*

infections encountered was *Anaplasma* spp and *Babesia* spp in both animals. The mixed infections observed in sheep was 3.13 % while that of goats was 1.9%. The prevalence in both animals in relation to sample areas is shown in Table 4. Prevalence in relation to sex and age is shown in tables 5 and 6 respectively. In sheep, male 12 (76.19%), female 56 (74.66%), and in goats, male 25 (68.42%) and female 46 (69.70%). Infected young and adult for sheep and goats were 10 (66.67%), 62 (76.54%) and 7 (50%), 64 (71.11%) respectively. Prevalence based on breed, for sheep and goats. In sheep, Yankasa 76.06%, WAD 76.47%, Uda 57.14% and Balami 100% while in goats, WAD 65.33% and Red Sokoto75.86%, respectively (Table 7). There were no statistical significance

TABLE 4: Prevalence of haemoparasites in different sample location in sheep and goats in Makurdi and Environs

Area	Number Examined	Positive	Prevalence (%)	Chi Square	P-Value	Odds Ratio
Sheep						
MW/Katungu	62	47	75.81			
Agan	22	17	77.27			0.92
Wurukum	0	0	0			0.00
UAM	2	2	100	1.94	0.58	0.61
Community						
Wadata	10	6	60			2.08
Goats						
MW/Katungu	39	24	69.54			
Agan	48	36	75			0.53
Wurukum	6	2	33.33			3.20
UAM	11	9	81.82	6.13	0.11	0.36
Community						
Wadata	0	0	0			0.00

MW=Mission Ward

TABLE 5: Prevalence of haemoparasites in relation to sex in sheep and goats in Makurdi

Specie	Sex	Number Examined	Positive	Prevalence (%)	Chi Square	P-Value	Odds Ratio
Sheep							
Sex	Male	21	16	76.19	0.02	0.89	
Goats	Female	75	56	74.66			1.09
Sex	Male	38	26	68.42			
	Female	66	46	69.70	0.17	0.68	0.83

TABLE 6: Prevalence of haemoparasites in relation to age in sheep and goats in Makurdi

Specie	Age	Number Examined	Positive	Prevalence (%)	Chi Square	P-Value	Odds Ratio
Sheep							
Age	<1Year	15	10	66.67			
	>1Year	81	62	76.54	0.65	0.42	1.09
Goats							
Age	<1Year	14	7	50.00			
	>1Year	90	64	71.11	2.49	0.11	0.83

differences between the serum plasma protein, mean PCV, RBC and WBC of the infected and the non- infected animals, since P- value (P>0.05) was greater than 0.05 as shown in figures I and II.

DISCUSSION

The overall prevalence of 71.5% recorded in this study is higher than 5% reported by Ademola and Onyiche, (2013), 57.6% by Ukwueze and Kalu, (2015), 43.39% by Anyanwu *et al*. (2016), and 20.84% by Opara *et al*. (2016). The high prevalence of

TABLE 7: Prevalence of haemoparasites in different breeds of sheep and goats in Makurdi

Breed	Number Examined	Positive	Prevalence (%)	Chi Square	p- value	Odds ratio
Sheep						
Yankasa	71	54	76.06			
WAD	17	13	76.47			0.98
Uda	7	4	57.14	1.58	0.66	2.38
Balami	1	1	100.00			1.03
Goats						
WAD	75	49	65.33	1.07	0.30	0.59
Red Sokoto	29	22	75.86			

WAD = West African Dwarf

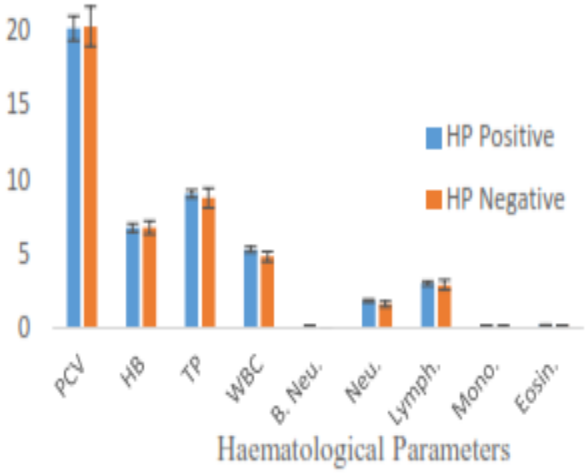

Figure I: Hematological parameters of haemoparasite positive and negative sheep

Key: PCV- Packed cell volume, HB- Haemoglobin, TP- Total protein, WBC- Total white blood cell, B.Neu- Band Neutrophils, Neu- Neutrophils, Lymph- Lymphocytes, Mono- Monocytes, Eosin- Eosinophil, Baso- Basophiles

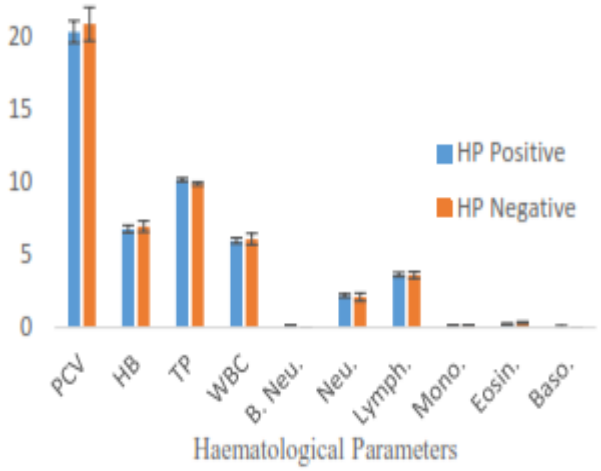

Figure II: Hematological parameters of haemoparasite positive and negative goat

Key: PCV- Packed cell volume, HB- Haemoglobin, TP- Total protein, WBC- Total white blood cells count, B. Neu-Band Neutrophils, Neu- Neutrophils, Lym- Lymphocytes, Mon, Monocytes, Eos. Eosinophil, Baso- Basophile

Anaplasma spp encountered in both animals in this study agrees with other authors (Adejinmi *et al*., 2004; Adamu and Balarabe, 2012; Anyanwu *et al*., 2016; Opara *et a*l., 2016), reported 11.2% in sheep,13% and 11%, 13.7% and 20.7%, 9.4 and 15.3% in sheep and goats respectively. Ajab *et al.* (2015) also observed similar result in bulkhi sheep in Pakistan, with a percentage prevalence of 28% *Anaplasma* spp. However, this may be attributed to the differences in the climatic condition of the study area (Makurdi) and the other studied areas. Makurdi is known for its high relative humidity that favours the survival and rapid proliferation of the vectors especially ticks, this translate to the high incidence of the infections. Another reason is that the attitudes of the small holder farmers toward Veterinary cares of their animals, most of them prefer selling or slaughtering an inactive or diseased food animals than

seeking Veterinary attention. The percentage prevalence was higher in sheep (75%) than goats (68%) in this study which is contrary to the previous reports by Opara *et al*. (2016), Anyanwu *et al*. (2016) who observed higher prevalence in goats than sheep. The *Babesia* spp being the second most prevalence in this study with the prevalence rate of 11.46% in sheep and 0.96% in goat is in agreement with other authors (Ng'ayo *et al*. 2005 Adejinmi *et al*., 2004; Anyanwu *et al*., 2016; Opara *et al*., 2016). The reason for this high incidence is not far from that of *Anaplasma* spp, since all are being transmitted mostly by ticks. However, the low prevalence rate of *Babesia* spp to *Anaplasma* spp could be due to the fact that animals that recovered from babesiosis become immune to re-infection as earlier reported by Adamu and Balarabe, (2012). Goats recorded low prevalence probably because of their hardy nature to some of the endemic diseases. The low prevalence of *Trypanosoma* spp. (1.04%) is in agreement with Josiah *et al*. (2015) and Opara *et al*. (2016), this may be due to the low incidence of the vectors (tsetse flies) during the period of the study since it has been reported that the population of the vectors varies with season of the year (Majekodunmi *et al*., 2013). Other reasons maybe that some of the indigenous small ruminants especially goats have some level of natural immunity against the trypanosomes (Ogbaje *et al*., 2011) and also could be that the sensitivity of the test used might be too low to detect subclinical or chronically infected animals thereby giving rise to so many false negative. Generally, the high percentage prevalence rate of haemoparasites may be attributed to the favourable environmental conditions for the survival and proliferation of the arthropod vectors. There are high prevalence rates in both sexes and age groups in this study but the relative higher prevalence rate in male sheep is in agreement with Anyanwu *et al*. (2016) whereas the higher prevalence in the female goats is in agreement with Abenga *et al*. (2008),Ademola and Onyiche, (2013), Ukwueze and Kalu, (2015) and Opara *et al*. (2016). The reason is that the female animals could have weak immunity from the stress of their extended breeding like calving and lactation. Other cyclical hormonal changes associated with gestation, parturition and calving processes. The high prevalence observed in the adult animals is in agreement with previous reports and this is because of the higher exposure of the adult during grazing than the young animals that are mostly fed indoor and some level of innate immunity by the young animals. The differences in breed susceptibility is not statistically significance so breeds is not a risk factor for infection by haemoparasites by small ruminants in the study area. The University community and Agan had the highest prevalence rate because of the attitude of the farmers toward Veterinary services since these areas are of distance from the metropolis than the other sampled areas. The slight anaemia observed in the infected animals suggests that the haemoparasitic infections was responsible for the anaemia as previously reported by Hornok *et al*. (2014). It has also been reported that anaemia is a reliable indicator for the severity of haemoparasitic infections in small ruminants (Okorafor and Nzeako, 2014). The mean PCV, WBC, Haemoglobin and other heamatological parameters of the non-infected animals were observed to be low in this study. However, eosinophil was observed to be within the normal range. This may be due to poor nutrition and other non-haemoparasite infections. The study revealed that breed, age, sex and sampling locations are not risk factors for acquiring the infections, since their P-value was greater than 0.05 ($P > 0.05$). All the haemoparasites encountered in this study can cause clinical diseases of economic importance in small ruminants thereby reducing their productivity.

Conclusion

The result of this study shows that haemoparasitic infections is common in

small ruminants reared by small holder farmers in Makurdi and its environ. Authors recommend that more research should be conducted in the areas of the vectors responsible for the transmission of these parasites to small ruminants in the study area. It is good to establish the genus and species of ticks and other arthropods responsible for the transmission of these parasites and also if government can give more support in funding for the control of these parasitic diseases.

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