



## The Prevalence of Spirochaetes and other Haemoparasites in Small Ruminants Slaughtered at Abattoirs in Ilorin Kwara State, Nigeria

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### ABSTRACT

#### Key words:

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The aim of this study was to investigate the prevalence of spirochaetes and other haemoparasites in small ruminants. A total of two hundred blood samples were collected from the jugular vein of sheep and goats at slaughter. The Microhaematocrit centrifugation technique, direct wet blood mount, thin blood smear and thick blood smear techniques were used to detect the presence of motile and non-motile haemoparasites. Data obtained were analysed using percentages and tabulations. One hundred and twelve representing 56.00% of the sampled small ruminants were positive for spirochaetes and other haemoparasites. Spirochaetes was the most prevalent haemoparasites followed by *Anaplasma ovis*, *Babesia* spp. and *Trypanosoma brucei*. Higher prevalence of haemoparasite infections were observed in goats (82.50%) compared to sheep (41.25%). Haemoparasites were more prevalent in small ruminants sourced from the southern part (78.00%) compared to those sourced from the northern part (54.00%) of Nigeria. Higher prevalence of spirochaetes and other haemoparasites was recorded in male than female. Some spirochaetes are zoonotic therefore, the possibility of its transmission to man exists with butchers and other abattoir workers been at risk of spirochaetosis. The role of ruminant types, sex of animals, and geographical locations in the epidemiology of spirochaetes and other haemoparasites infections in Nigeria is worthy of further investigations.

### 1. INTRODUCTION

Small ruminants account for an estimated 35% to the capital values of Nigerian livestock industry thereby contributing significantly to the meat, milk, hide and skin production as well as provision of socio-cultural values (Adamu and Balarabe, 2012). However, the benefits derived from sheep and goats in the tropics are way below the expected due mainly to low productivity linked to numerous factors, of which disease is the most important (Ademola and Onyiche, 2014).

Spirochaetes are flexible, coiled, motile organisms. They progress by rapid body movements (Cheesbrough, 2006). Spirochaetes of sheep and goats

includes *Borrelia* species *Treponema* species among others. These parasites are found in the blood and are tick-borne. They are associated with diverse clinical signs ranging in severity from asymptomatic infection to death (Sayers et al., 2009; Taylor et al., 2016). Haemoparasites are the major constraints to small ruminants' production globally (Jatau et al., 2011; Salih et al., 2015; Opara et al., 2016). The most economically important genera of these haemoparasites have been well documented (Okorafor and Nzeako, 2014; Demessie and Derso 2015). Haemoparasites, particularly trypanosomes, are known to cause anaemia in infected animals (Ola-Fadunsin et al., 2018). Haemoparasites have been shown to cause

destruction of red blood cells resulting in anaemia, anorexia, high morbidity and mortality, infertility, jaundice and weight loss (Ademola and Onyiche, 2014; Sharifi et al., 2016, Opara et al., 2016).

Some blood parasites had recently been reclassified under the microorganisms and been referred to as special bacteria; these include the hemoplasmas and the spirochaetes. Most of these organisms are highly fastidious to culture, and are poorly stained with Gram stain, so differential stains such as Giemsa are useful (Arora and Arora, 2010).

According to the World Organization for Animal Health (OIE, 2018) over 60% of known human pathogens are zoonotic and over 75% of emerging infectious diseases of humans having an animal origin. The human health burden and livelihood impact of zoonotic diseases in developing countries remains far greater than that of the developed world. Occupational zoonoses are diseases that result from exposure of humans to animal diseases during work related activities. An estimated 320,000 occupationally related deaths from infectious diseases are reported yearly worldwide (Haagsma et al., 2012). In Nigeria, abattoir workers constitute a major group at risk of contracting occupational zoonoses, due to the close contact that exists between them and animals/ animal tissues during slaughter and processing (Ngbede et al., 2012).

Haemoparasite infections are present across the climatic belts of the world, including the temperate, tropical or subtropical regions (Ukwueze and Ekenma, 2015), therefore studies on their prevalence and control is very important (Ademola and Onyiche, 2014; Kasozi et al., 2014, Opara et al., 2016, Salih et al., 2015). Little information is available on the incidences of haemoparasites in livestock in many parts of Nigeria as opined by Nwoha et al. (2013), and more research is needed on their economic and zoonotic importance in order to enforce preventive and control measures. We employed various parasitological procedures to investigate the prevalence of spirochaetes and other haemoparasites in small ruminants in order to provide baseline information on the diversity, prevalence and occupational hazards of these parasites among abattoir workers in Nigeria.

## 2. MATERIALS AND METHODS

### 2.1. Study design

We employed the total parasitological procedures to investigate the quality and health conditions of the small ruminants brought for slaughter at the central abattoirs at Ipata, Ilorin, Kwara State

Nigeria. A total of 200 small ruminants, comprising 80 sheep and 120 goats, were randomly sampled during the months of November and December of 2016. Records on the animal's source and sex were documented. Blood samples were collected from the jugular vein of each sampled animal. About 3-5 mls of blood was collected into sample bottles containing ethylene diamine tetra acetate (EDTA) to prevent blood coagulation. These were properly labelled, put in a cool box and immediately transported to the protozoology laboratory, Department of Veterinary Parasitology and Entomology, University of Ilorin for parasitological analysis.

### 2.2. Sample Preparation and Microscopy

The Microhaematocrit centrifugation technique as described by Cheesbrough (2009), the direct wet blood mount technique as described by Arora and Arora (2010) and thin and thick blood smears preparations as described by Cheesbrough (2009) and Ola-Fadunsin et al. (2018) were the diagnostic techniques used for the examination of blood samples. Identification of blood parasites was done using keys according to Cheesbrough (2006) and Taylor et al. (2016).

### 2.3. Statistical analysis

Data was descriptively analysed using percentages and tabulations. Analyses were conducted using Microsoft Excel 2016.

## 3. RESULTS

Of the total 200 hundred sampled sheep and goats, one hundred and twelve (56.00%) of them were positive for spirochaetes and other haemoparasites. Spirochaetes was the most prevalent haemoparasites followed by *Anaplasma ovis*, while *Trypanosoma brucei* was the least prevalent. Double haemoparasites infections were revealed in spirochaetes co-infected with *Anaplasma ovis* (5.50%), *Anaplasma ovis* co-infected with *Trypanosoma brucei* (2.50%) and spirochaetes co-infected with *Babesia* spp. (2.00%) (Table 1).

Higher prevalence of spirochaetes and other haemoparasites were found in goats (82.50%) compared to sheep (41.25%). Spirochaetes were more prevalent than other haemoparasites (*Anaplasma ovis*, *Babesia* spp. and *Trypanosoma brucei*) in both sheep and goats (Table 2).

The infection pattern of haemoparasite(s) infection in sheep and goats is presented in Table 3. Higher prevalence of mixed infection (15.00%)

compared to single infection (6.25%) was recorded in sheep, while the reverse was recorded in goats.

Generally, haemoparasites were more prevalent in small ruminants sourced from the southern part (78.00%) compared to those sourced from the northern part of Nigeria (54.00%). Spirochaetes were more prevalent in small ruminants bought from the southern part compared to those from the northern part of Nigeria. While, higher prevalence of other haemoparasites was detected in the sheep and goats from the northern part compared to those from the southern part of Nigeria (Table 4).

The infection rate for single haemoparasite infection was higher than that of mixed haemoparasites infection in sheep and goats sourced from both the northern and southern part of Nigeria (Table 5).

The prevalence of haemoparasites of small ruminants in respect to sex is showed in Table 6. Male were more infected with haemoparasites compared to female, with higher prevalence of spirochaetes and other haemoparasites recorded in male than female.

Higher prevalence of single haemoparasite infection than mixed haemoparasite infections was recorded in male and female sheep and goats (Table 7).

**Table 1:** Prevalence (%) of single and mixed haemoparasite(s) infection in sheep and goats in Ilorin (n=200).

| Haemoparasite(s) infection                                       | Number infected | Prevalence (%) | 95% CI             |
|------------------------------------------------------------------|-----------------|----------------|--------------------|
| Spirochaetes                                                     | 65              | 32.50          | 26.28–39.22        |
| <i>Anaplasma ovis</i>                                            | 21              | 10.50          | 6.80–15.34         |
| <i>Babesia</i> spp.                                              | 4               | 2.00           | 0.64–4.75          |
| <i>Trypanosoma brucei</i>                                        | 2               | 1.00           | 0.17–3.26          |
| Spirochaetes co-infected with <i>Anaplasma ovis</i>              | 11              | 5.50           | 2.93–9.36          |
| Spirochaetes co-infected with <i>Babesia</i> spp.                | 4               | 2.00           | 0.64–4.75          |
| <i>Anaplasma ovis</i> co-infected with <i>Trypanosoma brucei</i> | 5               | 2.50           | 0.92–5.45          |
| <b>Total</b>                                                     | <b>112</b>      | <b>56.00</b>   | <b>49.06–62.99</b> |

**Table 2:** Prevalence (%) of haemoparasites infection in sheep and goats in Ilorin.

| Haemoparasites       | Sheep (n=80)    |                | Goats (n=120)   |                |
|----------------------|-----------------|----------------|-----------------|----------------|
|                      | Number infected | Prevalence (%) | Number infected | Prevalence (%) |
| Spirochaetes         | 24              | 30.00          | 56              | 46.67          |
| Other haemoparasites | 9               | 11.25          | 43              | 35.83          |
| <b>Total</b>         | <b>33</b>       | <b>41.25</b>   | <b>99</b>       | <b>82.5</b>    |

**Table 3:** Infection pattern of haemoparasite(s) infection in sheep and goats in Ilorin.

| Haemoparasite(s) | Sheep (n=80)    |                | Goats (n=120)   |                |
|------------------|-----------------|----------------|-----------------|----------------|
|                  | Number infected | Prevalence (%) | Number infected | Prevalence (%) |
| Single infection | 5               | 6.25           | 87              | 72.50          |
| Mixed infections | 12              | 15.00          | 8               | 6.67           |
| <b>Total</b>     | <b>17</b>       | <b>21.25</b>   | <b>95</b>       | <b>79.17</b>   |

**Table 4:** Prevalence (%) of haemoparasites of small ruminants in Ilorin based on sources.

| Haemoparasites       | Northern Nigeria (n=100) |                | Southern Nigeria (n=100) |                |
|----------------------|--------------------------|----------------|--------------------------|----------------|
|                      | Number infected          | Prevalence (%) | Number infected          | Prevalence (%) |
| Spirochaetes         | 26                       | 26.00          | 54                       | 54.00          |
| Other haemoparasites | 28                       | 28.00          | 24                       | 24.00          |
| <b>Total</b>         | <b>54</b>                | <b>54.00</b>   | <b>78</b>                | <b>78.00</b>   |

#### 4. DISCUSSION

The total prevalence of haemoparasites found in this study was 56.00%, with spirochaetes been the most prevalent. The species distribution showed that goats harboured more of the spirochaetes than sheep. The spirochaetes infections were more in the animals reared in the south than those reared in the northern part of the country. The spirochaetes infections in males were more than that of female small ruminants. There has been no previous report of spirochaetes infection among small ruminants in Nigeria. A recent study on the prevalence of spirochaetes (*Borrelia burgdorferi*) among ruminants in Tunisia (Said et al., 2016) revealed a lower prevalence among sheep and goats compared to our findings. Differences in sampling method, geographic and climatic characteristics, level of tick control, diagnostic methods and state of studied animals could have led to the variation.

The relative high prevalence of spirochaetes and other haemoparasites we observed could be attributed to the favourable environmental conditions for the survival and proliferation of the arthropod vectors (especially ticks) that is responsible for the transmission of these diseases which is in agreement with the claims of previous studies as sheep and goats are reared mainly under extensive and semi-intensive systems in Nigeria (Adejinmi et al., 2004, Opara et al., 2016), thereby increasing their risk of been infected by

ticks. Infact, virtually all the sheep and goats examined in this study were infested with ticks.

Nwoha et al. (2013) recorded the highest prevalence of haemoparasites in ruminants in the month of November and December, with this corresponding to the high prevalence of haemoparasitic infections of sheep and goats were recorded, as our study was conducted between November and December.

In line with our findings, Nwoha et al. (2013), Ademola and Onyiche (2014) and Opara et al. (2016) documented that *Anaplasmas ovis*, *Babesia* spp. and *Trypanosoma brucei* are the haemoparasites affecting small ruminants in Nigeria. This study recorded *Anaplasma ovis* as the most prevalent haemoparasite after spirochaetes. This is followed by *Babesia* spp. and *Trypanosoma brucei*. This is similar to the report by Opara et al. (2016), who documented *Anaplasma* spp. as the most prevalent haemoparasite of small ruminants followed, by *Babesia* spp. and *Trypanosoma* spp. This study also agrees with previous studies that *Anaplasma* spp. is the most prevalent haemoparasite in both sheep and goats (Okaiyeto et al., 2008; Takeet et al., 2009). The low prevalence of *Trypanosoma brucei* we observed may be associated with the low density of *Glossina* species or the absence of *Glossina* spp. and incidental shipment of infected animals from endemic areas as reported by Nwoha et al. (2013).

**Table 5:** Infection pattern of haemoparasite(s) of sheep and goats in Ilorin based on source.

| Haemoparasite(s) | Northern Nigeria (n=100) |                | Southern Nigeria (n=100) |                |
|------------------|--------------------------|----------------|--------------------------|----------------|
|                  | Number infected          | Prevalence (%) | Number infected          | Prevalence (%) |
| Single infection | 40                       | 40.00          | 52                       | 52.00          |
| Mixed infections | 2                        | 2.00           | 18                       | 18.00          |
| <b>Total</b>     | <b>42</b>                | <b>42.00</b>   | <b>70</b>                | <b>70.00</b>   |

**Table 6:** Prevalence (%) of haemoparasites of small ruminants in Ilorin based on sex.

| Haemoparasites       | Male (n=100)    |                | Female (n=100)  |                |
|----------------------|-----------------|----------------|-----------------|----------------|
|                      | Number infected | Prevalence (%) | Number infected | Prevalence (%) |
| Spirochaetes         | 62              | 62.00          | 18              | 18.00          |
| Other haemoparasites | 29              | 29.00          | 23              | 23.00          |
| <b>Total</b>         | <b>91</b>       | <b>91.00</b>   | <b>41</b>       | <b>41.00</b>   |

**Table 7:** Infection pattern of haemoparasite(s) of sheep and goats in Ilorin based on sex.

| Haemoparasite(s) | Male (n=100)    |                | Female (n=100)  |                |
|------------------|-----------------|----------------|-----------------|----------------|
|                  | Number infected | Prevalence (%) | Number infected | Prevalence (%) |
| Single infection | 76              | 76.00          | 16              | 16.00          |
| Mixed infections | 16              | 16.00          | 4               | 4.00           |
| <b>Total</b>     | <b>92</b>       | <b>92.00</b>   | <b>20</b>       | <b>20.00</b>   |

We observed higher prevalence of haemoparasite infections in goats compared to sheep. Similarly, Opara et al. (2016) found goats to be more infected with haemoparasitic infections compared to sheep in their study. The fact that goats roam more than sheep may have made goats to be more exposed to the vectors (ticks and *Glossina* species) responsible for the transmission of these haemoparasites, and so its higher prevalence observed.

The prevalence of blood parasites infection is significant both in the animal bought from the northern and southern parts of Nigeria. Trypanosomosis, babesiosis and anaplasmosis are important haemoparasitic diseases that militates negatively on livestock production in tropical countries (Lako et al., 2007; Nwoha et al., 2013). Haemoparasites, particularly *Trypanosoma* species have remained a major concern in livestock production in Nigeria despite several therapeutic and control attempts (Samdi et al., 2008, Nwoha et al., 2013). Prevalence rate of the disease (Trypanosomosis) in livestock varies depending on the distribution of the vector (Tsetse fly) in endemic areas (Nwoha et al., 2013). Haemoparasitic infections in livestock production are important disease conditions which causes anaemia, debilitating conditions, poor performances, decrease in milk and meat production as well as immunosuppressive conditions predisposing infected animals to opportunistic infections (Ngole et al., 2003; Nwoha et al., 2013).

Opara et al. (2016) found higher prevalence of haemoparasites in male goats compared to female goats in their study conducted in Nigeria. Similarly, we observed a higher prevalence of haemoparasite infections in male sheep and goats compared to female. The more roaming nature of male in search of female could be the reason for our observation.

A good number the small ruminants examined had mixed infections of haemoparasite species which corroborates the findings of previous studies (Lako et al., 2007; Nwoha et al., 2013). This could be associated to the fact that ticks serve as the vector for spirochaetes, *Anaplasma* species and *Babesia* species. This implies that a tick vector can transmit more than one haemoparasite species at the same time when it takes a blood meal.

A proper understanding of the epidemiology of spirochaetes and other haemoparasites is a prerequisite to having a rational design for the effective control and preventive strategies against these dreadful diseases.

Several in-depth studies on the prevalence of spirochaetes have been conducted in various parts of the world but there is no record of spirochaetes infections in small animals in Nigeria and there is still paucity of information of other haemoparasites of ruminants in Nigeria (Okaiyeto et al., 2008, Nwoha et al., 2013, Opara et al., 2016), such as spirochaetes and its occupational hazards among the livestock handlers and abattoir workers in Nigeria. Losses in animal reproduction due to abortions, and the risk of zoonosis to humans is higher among the species and locations implicated in this study. High degree of parasitaemia of spirochaetes across species and geographical parts of Nigeria was observed in this study, this implies that animal handlers and abattoir workers might be at high risk of humans' Lyme spirochaetes, which demands urgent attention in further research and surveillances.

## 5. CONCLUSION

This study showed a high prevalence of spirochaetes and other haemoparasites in small ruminants shipped from different regions of the country into Ilorin abattoir, however strategic measures should be taken to control the vectors involve in their transmission. This study provides information on the prevalence of spirochaetes, *Anaplasma ovis*, *Babesia* spp. and *Trypanosoma brucei* in sheep and goats presented for slaughter; hence, there is a possibility of the transmission of spirochaetes to humans, especially animal handlers and abattoir workers. The prevalence might be higher using a more sensitive technique such as Polymerase Chain Reaction (PCR) and serology. The significance of spirochaetosis infected animals' in this study highlights the importance of haemoparasites in animal production and the relevance of proper surveillance programmes to enforce early control measures. We were expecting to detect Haemoplasmas in our study, the fact it was not detected does not fully rule out its absence in Nigeria, so we recommend further studies using a more sensitive technique to determine its status among ruminants in Nigeria. There should be provision of government established Veterinary clinics in communities working alongside with human health centres to improve on zoonotic disease surveillance and control for a good public health assurance in Nigeria.

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