Retrospective study on the prevalence of *Babesia* species in traumatic cases of dogs presented to Veterinary Teaching Hospital, ABU Zaria, Nigeria from 2008 – 2018

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**Introduction**

*Babesia canis* is a tick-transmitted hemoprotozoan parasite that induces anaemia, fever, jaundice, ahemoglobinuria and sometimes fatal symptoms in dogs. *B. canis* is classified into three subspecies: *B. canis rossi*, *B. canis vogeli* and *B. canis canis*. The *Babesia* species are transmitted by the tick *Haemaphysalis leachi* and *Rhipicephalus sanguineus*. The pathogenesis of *Babesia* infection is complex and involves various factors, including the tick species, the host's immune response, and the strain of the parasite (Oyamada et al., 2005).

*Babesia* infection is increasing in prevalence and is now a major problem in dogs. During this study, a total of 358 case-files recorded between 2008-2018 (11 years) were retrieved from the Small Animal Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University, Zaria, with the chief complaint of trauma of different forms. These dogs were registered in the clinic and were on routine veterinary medical care before presentation for trauma. For each case, the Protozoology laboratory results were matched with the records from the Small Animal Clinic reception to determine whether there was *Babesia* species in the blood, precipitated by the trauma. Statistical analysis showed that 3.1% of the dogs presented with traumatic injuries within the study period were found to be positive for *Babesia* species. Male dogs (3.6%) with traumatic injuries were more prone to the infection than female dogs (2.3%), whereas the prevalence of *Babesia* species was higher in younger dogs (17.4%) with same condition than older age groups (2.1%). Crossbreds (7.5%) with traumatic injuries were more prone to the infection than the exotic (4.5%) and local breed (0.9%). However, none of them were completely resistant. Statistical analysis of the data obtained showed that there was a significant association between the presence of *Babesia* species and the age and breed of dogs with traumatic injuries that were presented to the clinic. This study has shown that traumatic injuries could be a predisposing factor to *Babesia* infection in dogs.
There are more than 100 known Babesia species. Babesiosis is one of the most common infectious diseases of mammals worldwide and it has gained increasing interest as its zoonotic potential has become increasingly recognized (Homer et al., 2000). The increasing number of canine Babesia species, geographical distribution, varying tick vectors and modes of transmission often result in diverse of pathogenic and clinical presentations (Ayoob et al., 2010).

The clinical and pathological presentation of canine babesiosis varies and is also dependent on the species/subspecies responsible for the infection; however, the classical presentations often include: thrombocytopenia, febrile syndrome (fever, anorexia, depression, dehydration) and haemolytic syndrome (anaemia, bilirubinuria, haemolysis) in acute cases while the chronic form corresponds to prolonged convalescence characterized by depression (Solano-Gallego et al., 2008).

Like other mammalian hosts, dogs are susceptible to intestinal parasitic helminthes and protozoa, including species of epidemiological significance that may be a source of severe disease for humans (Bajer et al., 2010). Dogs may also be infected with pathogenic haemoparasites including Babesia species (Nalubamba et al., 2011). Canine babesiosis has been described as an emerging veterinary problem worldwide (Irwin, 2009).

Transmission of Babesia parasite to the canine host is by the bite of specific ixodid tick vectors. Thus, the specie of Babesia prevalent in a particular area is influenced by the presence of the specific tick vector in that geographical area (Matjila et al., 2004). Infection in dog may also occur by direct transmission via blood transfer from dog bites, blood transfusion or transplacental transmission (Uilenberg, 2006).

Babesia infections are traditionally diagnosed based on the detection of the parasites in thin blood smears stained with Giemsa, Romanowsky and field stains under a microscope. The blood smears prepared from capillary blood and buffy coat readily reveals the parasites since the parasitized erythrocytes tend to sludge in the capillaries and also preferentially parasitize the reticulocytes over the mature red blood cell (Bohm et al., 2005).

Trauma encompasses physical or psychological injury to a human or animal (WebMD, 2008). Physical injury can be caused by nonpenetrating (blunt) or penetrating trauma. Blunt trauma includes vehicular trauma, crush/compression or acceleration/deceleration injury. Traumatic injury can result in acute death due to overwhelming primary damage, initial survival and subsequent death due to complications (delayed haemorrhage, multiorgan dysfunction, infection or sepsis) or patient survival to discharge (Sauaia, 1995).

The systemic response to severe injury involves interactions across the haemostatic, inflammatory, endocrine and neurological systems, aggravating initial damage caused by hypoperfusion (shock) and reperfusion. Endothelium activated by exposure to inflammatory cytokines becomes more porous, allowing mediators of tissue damage to gain access to the intercellular space. The systemic responses to major trauma are also associated with lowered ability to fight infection, leading to sepsis and further activation of the destructive inflammatory response (Lord et al., 2014). Severe injury is associated with the Systemic Inflammatory Response Syndrome (SIRS) (Zhang et al., 2010). The inflammatory response also includes rapid activation of the complement system — initial activation is followed by consumption and a subsequent imbalance in the components of the complement cascade, which is one of many factors that reduces the ability of the body to defend against microorganisms (Burk et al., 2012).

The aim of the study was to determine the prevalence of Babesia species in traumatic cases of dogs presented to the Small Animal Clinic of the Veterinary Teaching Hospital, ABU Zaria. This may add more knowledge to this disease in Zaria, which in turn may help to control the disease, through avoiding as much as possible the exposure of dogs to different forms of trauma which depresses their immunity, predisposing them to this disease.

Materials and Methods

Study design

Total of 358 case-files recorded between 2008-2018 (11 years) were retrieved from the Small Animal Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University, Zaria. All had the chief complaint of trauma of different forms. History revealed that the dogs were registered and were receiving routine veterinary medical care such as tick bath, deworming, vaccination etc. before presentation for trauma. History also revealed that blood samples were collected from the cephalic vein of all the dogs presented and sent to the Protozoology laboratory for haemoparasite screening. The blood samples containing Ethylene Di-amine Tetra-acetic Acid (EDTA) were examined using Giemsa stained thin blood smears to detect Babesia species pyriform and or round shape pirolasms in red blood cells.

For each case-file, the Protozoology laboratory results were matched with the records from the small animal clinic reception to determine whether there was Babesia species in the blood, possibly precipitated by the trauma.
Data analysis
Data retrieved from the case-files were analyzed with Statistical Package for Social Science (SPSS) version 20.0. Chi-square was used to determine association between Babesia species and factors such as age, sex and breed. Odds ratio (OR) and 95% confidence interval were used on dichotomous variables to test the strength of association. P values ≤ 0.05 were considered significant.

Results and Discussion
The overall prevalence of Babesia species in dogs with traumatic injuries was 3.1% (Table 1). Higher prevalence of Babesia species was observed in dogs less than one year of age (17.4%) with traumatic injuries than dogs of at least one year of age (2.1%) with traumatic injuries. Statistical analysis of the data revealed that there was significant association (p=0.00) between the presence of Babesia species and age of dogs with traumatic injuries that were presented to the clinic. Information from the analyzed data also revealed that male dogs (3.6%) with traumatic injuries could be more prone to Babesia infection than female dogs (2.3%) with the same condition, though there was no significant association (p=0.491) between the presence of Babesia species and sex of dogs with traumatic injuries. The highest percentages of Babesia species positive cases were found in crossbreds (7.5%), followed by exotic breeds (4.5%), whereas lowest percentages were found in local breeds (0.9%). Statistical analysis of the data showed that there was significant association (p=0.004) between the presence of Babesia species and breed of dogs with traumatic injuries that were presented to the clinic within the period.

The results of the present study suggest that dogs < 1 year of age were more likely to be infected with Babesia species than the dogs of other ages with traumatic injuries. This may be due to an increased susceptibility to infection or less immunity due to traumatic injury. On the other hand, the older dogs were less prone to Babesia infection this may be due to non-specific or innate factors possessed by the hosts which act as natural protective element (Levy et al., 1982). The study suggests that male dogs could be more prone to this disease than the females, which indicates bite wounds or blood transmission during fighting contact in male dogs, thus possible routes of transmission for Babesia parasite. The study also showed that the most susceptible breed of dogs in Zaria were crossbred dogs, followed by the exotic and the local breed. This may be due to the modification of genetic traits in the course of breeding which may lead to changes in innate immunity, increasing susceptibility to the infection.

Traumatic injuries may result in loss of continuity, loss of function, pain and haemorrhage. The most frequent causes of trauma in small animals are automobile accidents, bites from other animals, broken glass and other sharp objects. The location, nature and extent of the lesions vary from the smallest abrasion to gross lacerations that are badly contaminated and accompanied by complicating internal injuries like splenic ruptures. Other organs of the immune system which may be traumatized in cases of Road Traffic Accident (RTA) include bone marrow, the thymus, various lymph nodes and aggregates of lymph tissue spread throughout the body. The possibility of trauma predisposing dogs to heavy tick infestation, probably by being immobilized as a result of the trauma exist, thus increased tick infestation in dog increases the chances of Babesia infection as ticks serve as vectors.

Table 1: Prevalence of Babesia species in traumatic cases of dogs presented at the Veterinary Teaching Hospital, ABU Zaria from 2008 – 2018

<table>
<thead>
<tr>
<th>Factors</th>
<th>Number examined</th>
<th>Number positive</th>
<th>Specific rate (%)</th>
<th>Odds ratio (OR)</th>
<th>95% confidence interval on OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1 year</td>
<td>23</td>
<td>4</td>
<td>17.4</td>
<td>9.87</td>
<td>2.66-36.66</td>
</tr>
<tr>
<td>≥ 1 year(ref)</td>
<td>335</td>
<td>7</td>
<td>2.1</td>
<td>1.0</td>
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</tr>
<tr>
<td>Sex**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>225</td>
<td>8</td>
<td>3.6</td>
<td>1.60</td>
<td>0.416-6.129</td>
</tr>
<tr>
<td>Female(ref)</td>
<td>133</td>
<td>3</td>
<td>2.3</td>
<td>1.0</td>
<td>-</td>
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<tr>
<td>Breed***</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local breed</td>
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<td>2</td>
<td>0.9</td>
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<td>-</td>
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<td>Crossbred</td>
<td>107</td>
<td>8</td>
<td>7.5</td>
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<tr>
<td>Exotic breed</td>
<td>22</td>
<td>1</td>
<td>4.5</td>
<td>-</td>
<td>-</td>
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<td>Total</td>
<td>358</td>
<td>11</td>
<td>3.1</td>
<td></td>
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</tr>
</tbody>
</table>

Ref= reference category
*Χ²=16.921, p= 0.000
**Χ²=0.474, p= 0.491
***Χ²= 10.848, p= 0.004
Acknowledgements
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References