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Research Article

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Tick-Borne Parasites of Local Dogs (Mongrels) (*Canis familiaris*) in Wamba Local Government Area of Nasarawa State, Nigeria

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Abstract

Tick-borne diseases (TBD) are major challenge to animal production and health in Nigeria. They threaten domestic animal wellbeing thus leading to economic loss. Therefore, this research looked at tick-borne parasites in local dogs (mongrels), in Wamba Local Government Area (LGA) of Nasarawa State, Nigeria. Two hundred and fifty-two (252) dogs were randomly examined for ticks and haemoparasites. Haemolymph and thin blood smears were used for parasitological examination. A total of 648 ticks were collected from the dogs screened. One hundred per cent (100%; 648 ticks) of dog and-non-dog ticks Rhipicephalus sanguineus Rhipicephalus (Boophilus) decoloratus), respectively, screened were found to be positive for Babesia parasite which was at various developmental stages in which the blastokinete proportion was the most dominant, yet differences was not significant ($\chi2$ = 3.1307, df = 2, P = 0.209). Out of the 252 dogs screened, 201 individuals (79.8%) were infected by only Babesia parasite spread across puppies 39 (76.5%), adolescents 26 (100.0%) and adults 136 (77.7%). However, Babesia prevalence variations across age groups showed no significant difference (P > 0.05). On the minimum, over 77% of the dogs examined had their haematological indices within the normal range. The results in this study shows that Babesia is common in dogs in Wamba LGA of Nasarawa State. Also, despite the high rate of parasitemia, the dogs were asymptomatic and anaemia was not significantly made manifest in the dogs in this study. In conclusion, it is recommended that dog owners should get their dogs vaccinated as well as regularly clean dog kennel and trim the grasses around their houses so as to limit tick-dog contact.

Keywords: Local Dogs, Mongrels, Ticks, Tick-Borne Diseases, Haemoparasites, Piroplasm, Sporokinetes, Blastokinete, Vaccination, Sanitation, Wamba LGA, Nasarawa State.

Introduction

Ticks are vectors of human and animal diseases. They infest and feed on a wide range of domestic and wild animals and transmit a greater variety of infectious agents than any other arthropod group [1]. The local dog (mongrel) is disease resistant, good at hunting and very smart. In tropical countries, dog infection with haemoprotozoa is common [2]. Ticks harbor and transmit various pathogens to susceptible hosts when they take a blood meal. *Rhipicephalus sanguineus* is a typical dog tick feeding on dogs. Its distribution is global wherever dogs live [3]. The *Boophilus* tick commonly known as cattle tick is also occasionally found on dogs [4]. The dog tick *R.sanguineus*, renders dogs at risk with severe infection with *Babesia canis* which is contagious and can be very debilitating to domestic animals and pets and may also affect humans. Accumulated effects of the biting stress cause loss of appetite, loss of blood leading to anaemia and lowered growth rate. Ticks cause death of young animals due to abortion, reduced milk production, weakness and immunosuppression [5].

A tick bites with a barbed straw-like mouth part and squirts saliva which contains toxins, pathogens and other materials that can cause a range of health issues. Ixodid tick causes paralysis to mammals like dogs [6]. Allergic reaction to tick saliva can range from mild, where the bite gets red, swollen and inflamed, to life threatening anaphylaxes. Large populations of wild animals provide a reservoir of ticks and infective microbes that spread to domestic animals. *Rhipicephalus sanguineus*, a dog tick feeds majorly on dogs; its distribution is global. Ticks as vectors of diseases feed repeatedly on blood and have long lives.

At each feeding a tick secretes saliva containing powerful enzymes and substances with strong pharmaceutical properties to maintain flow of blood and reduce host immunity and very often results in various forms of toxemia [7]. Dogs are at risk with severe infection with *Babesia canis* transmitted by the dog tick *Rhipicephalus sanguineus*. It may occur by tick transmission, direct transmission through dog bites, blood transfusion or transmission through the placenta. The common mode of transmission however is via a tick bite [8]. There is limited documented information on the prevalence of tick-borne parasite infection and haematological conditions of local dogs (mongrels) in Wamba Local Government Area (LGA) of Nasarawa State, Nigeria. Hence, this research investigated tick-borne parasites and their haematological status of the mongrels in Wamba LGA, Nasarawa State, which will at the long-run reveal the abundance of ticks infesting dogs as well as the haemoparasites in both tick and non-tick infested dogs which can bring about informed decision by dog owners.

Materials and Methods

Study Area

This study was conducted in Wamba LGA of Nasarawa state, Nigeria, with the coordinate's latitude 8°56´35.55"N and longitude 8°36´8.37"E. It has an average temperature of 31°C. The Local Government Area has 10 wards and each ward was divided into three zones with each zone having at least 5 settlements. This was done for convenience of sampling for this study.

Ethical Approval

Ethical approval was sort from the Nasarawa state Ministry of Agriculture through the Local Government Area office Wamba. The Veterinarian was used to collect blood samples from the dogs. Also, verbal permission to bleed the dogs and collect blood samples was sought from the owners keeping such dogs before commencing the experiment.

Samples Collection and Processing

Extraction and Examination of Tick Haemolymph for Pathogens

Ticks were collected from dogs in selected houses after dog owner's consent. Tick haemolymph was extracted according to the method of Aguilar-Díaz et al. [9]. Prior to the extraction of the haemolymph, all ticks that were alive were placed in 3% topical hydrogen peroxide for five minutes for surface sterilization. The ticks were then placed on a clean grease free microscope slide and viewed under a dissecting microscope at x10 magnification. The tick's dorsum was gently pushed down with forceps to spread the tick's legs. The coxa (intersegment membrane) of the first pair of legs was amputated with a fine pointed scalpel. After the amputation, pressure was applied gently to the tick's dorsum and haemolymph exuded out onto the slide. The tick was then gently moved around on the slide to spread the haemolymph [10]. The released haemolymph was fixed in absolute methanol and stained with Giemsa stain and then microscopically examined under oil immersion lens [11, 12].

Blood Collection and Screening for Parasites

Blood samples were collected from any available dog in the selected houses sequel to the consent of dog owners using a 5 ml syringe, and sterile 18-gauge hypodermic needle, through the large vein on the forelimb of each of the sampled dogs. The blood was transferred into an anti-coagulation plastic tube and transported in ice pack container, Coles to the Department of Zoology, Federal University of Lafia. Part of the blood for determination of haematological indices was sent to the haematology laboratory of ECWA Veterinary Hospital, Bukuru, Jos South Local Government Area, Plateau State, for haematological analysis. Ages of the dogs was ascertained according to the owners report as well as the veterinarian assessment. The dogs were grouped into 0 – 6 months, 7 – 12 months, and above 12 months [13-15]. To ensure that no dog was screened twice, stray dogs were exempted and only dogs found in the owner's home were examined and each dog after screening was marked with a stroke on the inside of the right pinna using indelible ink.

A drop of blood was placed on a grease free glass slide for a thin blood film. A clean glass slide was placed at an angle of 45° onto the drop of blood allowing the blood to spread along the contact line of both slides. The cover slide was quickly pushed towards the unfrosted end of the lower slide. The thin film was then allowed to dry in air then fixed in absolute methanol for 5 minutes [16]. The fixed thin blood film was then stained with dilute Giemsa stain (1:10) for 45 minutes [17]. The slides were rinsed by gently flooding them with buffered water until the stain was removed. The slides were allowed to dry completely away from dust.

The parasites were viewed using oil immersion objective x100 and they were identified using Morel et al. [18]. Parasite identification key for tick-borne pathogens. The blood films were viewed using oil immersion objective x100 for presence of blood parasites [18]. For the wet mount, a drop of blood was placed on a clean grease free slide and cover slip gently lowered on the drop. The cover slip was gently tapped to expel air bubble trapped; the mount was examined for trypanosome.

Haematological Analysis

The haematological status of the dogs screened for tick-borne haemoparasites was determined in relation to the protocol described by Sunitha [19]. The outcome of each dog's measurements was compared with the already established standard or normal range values for: RBC 5.5 – 8.5, Hb 11.9 – 18.9, PCV 35 – 37, Platelets 200 – 500, and WBC 6.0 - 19.5.

Statistical Analysis

Data obtained was analyzed using R Console software version 4.1.1. Chi-square test was used to compare the prevalence of tick-borne parasites in ticks that infested on dogs as well as across haematological indices status of the dogs. Level of significance was set at $P < 0.05$.

Results

Parasitic Infection Status of Ticks Recovered from Mongrels

All the 648 (100%) dog (*Rhipicephalus sanguineus*) and-non-dog (*Rhipicephalus* (*Boophilus*) *decoloratus*) ticks screened were found to be positive for *Babesia* parasite which were at various developmental stages of which the blastokinete was the most dominant, but differences was not significant ($\chi2 = 3.1307$, df = 2, P = 0.209, Table 1). The predominant developmental stage in *R. sanguineus* and *R. (B.) decoloratus* was the clubbed shaped vermiform blastokinete 265 (46.0%) and round amoeboid shaped piroplasm 37 (51.4), respectively.

Table 1: Prevalence of Parasites in Ticks

Tick Type	Species	No. Examined	*Babesia* Developmental Stages in Ticks (%)		
			Piroplasm	Sporokinete	Blastokinete
Non-dog tick	*Rhipicephalus (B.) decoloratus*	72	37 (51.4)	30 (41.7)	5 (6.9)
Dog tick	*Rhipicephalus sanguineus*	576	150 (26.0)	161 (28.0)	265 (46.0)
	Total	648	187 (28.9)	191 (29.5)	270 (41.7)

Tick-Borne Infection in Mongrels

Two hundred and fifty-two (250) samples of dog blood were examined for tick-borne parasites out of which 201 (79.8%) were infected with *Babesia* species while other haemoparasites were not found (Table 2). *Babesia* was most prevalent in adolescent dogs (7 - 12 months) 26 (100.0%) followed by adults (>12 months) 136 (77.7%) while puppies (0 – 6 months) had the least infectivity rate 39 (76.5%). However, there was no significant difference ($\chi2 = 4.1381$, df = 2, P = 0.1263) in the prevalence of *Babesia* infection in relation to age groups of the dogs.

Table 2: Prevalence of *Babesia* Infection in Tick Infested Dogs

Age (Months)	No. Examined	No. Infected (%)
0-6	51	39 (76.5)
7-12	26	26 (100.0)
>12	175	136 (77.7)
Total	252	201 (79.8)

Haematological Profile of the Screened Dogs

The haematological indices screening revealed, 77.0%, 92.1%, 96%, 95.6% and 95.6% of the dog blood screened conform to the normal range of the RBC, Hb, PCV, Platelet and WBC, respectively, as shown in Table 3.

Table 3: Haematological Status of Mongrels

Parameter	Normal range (NR) value	No. of Dogs < NR (%)	No. of Dogs within NR (%)	No. of Dogs > NR (%)
RBC (x106µl)	5.5 – 8.5	40 (15.9)	194 (77.0)	18 (7.1)
Hb (g/dl)	11.9 – 18.9	14 (5.6)	232 (92.1)	6 (2.4)
PCV (%)	35 – 37	6 (2.4)	242 (96.0)	4 (1.6)
Platelet (x106µl)	200 – 500	2 (0.8)	241 (95.6)	9 (3.6)
WBC (x106µl)	6.0 - 19.5	2 (0.8)	241 (95.6)	9 (3.6)

Discussion

Parasitic Infectivity in Ticks

The only parasite found in this study infecting the ticks recovered from mongrels was *Babesia* species which likely implies potential for transmission, disease risk, vectorial capacity and persistence in the ecosystem, active *Babesia* parasite circulation in the local environment of Wamba LGA, Nasarawa state making the ticks their serve as reservoir hosts. This study conforms to the outcome of Opara et al. [2]. who reported Babesia species as the most prevalent parasite found in tick haemolymph. All the different stages were identified in different proportions in the ticks examined. The high infectivity rate of blastokinetes (46%) recorded in *R. sanguineus* possibly suggests that it is the major species responsible for the transmission of babesiosis in dogs in the research area. The presence of blastokinetes determines the production of sporozoites which initiates new infection when introduced into susceptible host [20]. Likewise, the presence of the various stages of the parasites in the ticks in this work indicates ongoing as well as continuous transmission of the disease in the population of dogs. Similarly, the developmental stages of *Babesia* have also been reported by Shitta et al. in dog population in Jos North LGA of Plateau state, Nigeria [21].

The occurrence of ticks of the genus *Rhipicephalus* in this study confirms that the dog tick is thriving very well in the area and possibly suggests that the infection they transmit would be prevalent in Wamba LGA of Nasarawa State, Nigeria. The finding is in conformity with that of Opara et al. [2]. whose investigation on ticks of dogs in the Federal Capital Territory (FCT) Abuja, Nigeria, revealed the presence of *Rhipicephalus* as the only ticks on dogs in the FCT area. Dogs in communities in Wamba are owned but not confined in any manner, a behaviour that to a large extent guarantees availability of host for dog ticks thereby making disease transmission efficient. Free roaming behavior is suspected of being a significant risk factor for high vector prevalence and haemoparasites transmission.

Prevalence of Tick-borne Parasites in Tick and Non-Tick Infested Dogs

Just like the infections in the ticks, *Babesia* parasites were identified in the blood of both tick and non-tick infested dogs examined suggests that *Babesia* can also be transmitted transovarial. The high babesiosis infection rate of 79.8% in mongrels reveals that the disease constitutes a major health problem of dogs in the study area. The prevalence observed tallies with the investigation of Opara et al. [2]. who noted that local breed of dogs is highly infected with *Rhipicephalus* borne haemoparasite.

The lack of variation in the prevalence of *Babesia* infection in relation to the ages of the dogs clearly suggests that the parasite is not age-specific. The result in this study conforms to previous studies by Ogbu et al. who reported that age, sex and breed of the animal did not have any significant influence on the prevalence of *Babesia spp.* [22]. Our result is in agreement with the report by Opara et al. [2]. that found highest occurrence of *Babesia* species in dogs of age 7 – 12 months. On the contrary, this is not in agreement with Birkenheuer et al. who reported that *Babesia* species prevalence was highest in adult dogs from North Carolina USA. Also, a study inin South Africa showed that babesiosis caused by *Babesia canis* was more severe in adult dogs of age 12 months and above, than those less than 12 months [23, 24].

Haematological Status of the Dogs

All the haematological indices determined in the blood of the screened animals were within the normal range values for dog blood which could indicate that the blood parameters in the dogs were not significantly altered to reflect disease and or the dogs were in stable carrier state (i.e. parasite present in the blood at low levels but the dog's immune system is managing the infection well enough to prevent overt disease or significant changes in blood parameters). Also, the maintenance of the normal blood parameters values registered suggests that some form of medications might have been administered. On the other hand, studies in Paraguay and Kannur District of Kerala in India observed haematological alterations in dogs infected by *Babesia* species [25, 26].

Conclusion

This study shows that the tick species *Rhipicephalus sanguineus* was more in number, however both dog and-non-dog tick species had the *Babesia* infective haemoparasite of dogs. Only Babesia infection was observed in both tick and-non-tick infested dogs which accounted for 79.8% infectivity rate and occurred the most in adolescent dogs (7 - 12 months; 26 [100.0%]). The haematological parameters of both infected and non-infected dogs had no alteration. The high prevalence of *Babesia* in the local dog population in the area calls for an urgent veterinary attention in order to ameliorate the risk faced by these animals. Dogs' exposure to ticks should be prevented by using appropriate tick control products and removing any tick sighted on the body of dogs very promptly so as to reduce the risk of dogs' exposure to infection. Dog owners should get their dogs vaccinated as a preventive measure against *Babesia* infection.

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