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Research Article

Prevalence and Risk Factors of Tick Infestation in Dogs in Ibadan, Nigeria

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ABSTRACT

Tick infestation in dogs is a major concern to dog owners. The abundance and distribution of ticks and tick-borne diseases have been extensively reported, but not from the dog owner's perspective. Herein, we examined tick infestation and density in dogs and the associated risk factors around Ibadan. Structured questionnaire was distributed among dog owners on knowledge of tick infestation. A total of 130 dogs of different breeds, ages and sex were examined in eight veterinary hospitals within Ibadan metropolis between July and September 2018 using purposive sampling. Risk factors include breeds, control methods, age, sex, geographical location and management. Common method of tick control employed by dog owners were; tick spray 18 (16.8%), tick powder 41 (38.3%), injections 22 (20.6%), and bathing 26 (24.3%). Dogs with the age less than 12 months were the most infested, while those within the age of 24 – 120 months were the least infested. Female dogs were more infested than the males. The prevalence of tick infestation in this study was 56.2% with the head region being the most predilection site of attachment of ticks. *Rhipicephalus sanguineus* was the most common tick infesting dogs. Demographic characteristic of dog owners, their knowledge on tick infestation, age of dogs, breed and sex have no significant influence on tick infestation. Previous tick infestation was highly significant (P = 0.001). Dogs domiciled in Ibadan were observed to be at risk of tick infestation. Continuous prophylactic and biosecurity measures could be strategically used in preventing tick infestation in this tropical region.

Keywords: *Dogs; Prevalence; Knowledge; Ibadan*

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INTRODUCTION

Tick is the most common ectoparasites of dogs in Nigeria, which transmit a wide range of protozoa, bacterial and rickettsial pathogens to susceptible hosts. Among several tick species, the brown dog tick, *Rhipicephalus sanguineus*, of the family Ixodidae, is the most encountered species of veterinary importance affecting dogs in this tropical environment. *Rhipicephalus sanguineus* infest the environment including kernels and houses, thereby causing skin irritation, anaemia, fever, jaundice, weakness and possibly death. Common blood parasites transmitted by *Rhipicephalus* include, *Babesia* spp., *Ehrlichia* spp., *Anaplasma* spp., *Hepatozoon* spp. and *Theileria* spp. (Kamani *et al.*, 2013). Several studies have indicated the abundance of *Rhipicephalus sanguineus* could be influenced by environmental factors especially high temperature, rainfall, humidity, hygiene and availability of suitable host (Okoli *et al*., 2006; Costa *et al*., 2013; Drexler *et al*., 2014). Previous study reported the significant increase in susceptibility of *R. sanguineus* in exotic breeds of dogs compared to local breeds, thereby predisposing them to haemoprotozoans (Okoli *et al.*, 2006).

In Nigeria, other ticks of dogs identified include; *Boophilus* spp., *Hyalomma* spp. and *Amblyoma variegatum* (Adamu *et al.*, 2014; Burroughs *et al.*, 2016; Greay *et al.*, 2016; Abdulkareem *et al.*, 2018). However, *R. sanguineus* is the most common and its ubiquitous distribution has been facilitated by increase in dog population and movement. The

distribution has been reported to be affected by season, with its abundance more prominent in the wet season. Earlier studies have reported the collection of *R. sanguineus* from both exotic and local dogs in several part of the country (Dipeolu, 1975; Kamani *et al.,* 2013). They have been observed to infest humans in Nigeria (Okoli *et al.,* 2006), while Mediterranean spotted fever (*Rickettsia conorii*) were reported to be transmitted *R. sanguineus* in tropical and sub-tropical countries (Beninati *et al.,* 2002; Kamani *et al.,* 2013). Dog keeping in Ibadan is mainly for security and breeding purpose and most are owned and confined (Odeniran and Ademola, 2013). Ibadan is located in the rainforest region of Nigeria endowed with favourable environmental factors suitable for the proliferation and adaptation of ticks and haemoparasites. Providing prevalence data on dogs infested with ticks could be obscured and bias. The determination of true prevalence and associated risk factors should consider dogs of all ages, sexes, breeds amongst other variables. Preference or predilection sites of various tick species on dog's body is an important indicator.

More than half of dogs examined in a study in Makurdi, Nigeria were infested with ticks (Amuta and Houmsou, 2010), but there was higher prevalence in free roaming dogs. Dogs also serve as a food source and their meat is considered as a delicacy among some groups in Nigeria. These can expose humans to zoonotic diseases emanating from tick-borne pathogens. This study aims to consider the prevalence of tick infestation in dogs presented at the veterinary hospitals in Ibadan so as to assess the spatial distribution patterns, the risk factors for attachment and the determination of attachment rate in dogs.

MATERIALS AND METHODS

Study location: The study was conducted in eight veterinary hospitals/clinics in Ibadan. Ibadan is the major town in Oyo state with higher number of people with several commercial enterprises. Ibadan also has a larger number of dog owners and major veterinary practices are located in Ibadan. Ibadan is the capital city of Oyo state which covers a total of 27,249 square kilometers of landmass and it is bounded in the south by Ogun state, north by Kwara state, in the southwest, it is partly bounded by Ogun state and partly the republic of Benin, while in the East by Osun state. The topography of the state is of gently rolling lowland in South, rising to a plateau of about 40 meters.

Sampling technique/ Study design: Out of the 11 local government areas in Ibadan, four local governments were randomly sampled. At least one registered veterinary hospital/clinic was selected from each local government to make a total of eight veterinary hospitals. Two of the veterinary hospitals were public-owned while the other six were private-owned premises. The study lasted for three months (July to September 2018). Small animal / mixed practice veterinary hospital seeing a minimum of five dogs a week and willing to participate in the study for three months because of the limited time available for the study. The study design is a cross sectional study, while a structured questionnaire was administered on the dog owners.

Data collection: Veterinary practitioners were involved in examination of every dog brought to their clinic for ticks. Participatory veterinary practices were provided with a protocol to ensure uniformity in data collection. The questionnaire comprised closed-ended questions with information about the demographic characteristics of dogs and their owners, and knowledge of tick infestation. Information on all inspected dogs was recorded regardless of whether ticks were present or not.

Standardized protocol to ensure uniformity in data collection was designed by the investigator. A five-minute inspection by animal health worker(s) on duty was carried out on every dog brought to the clinic by checking all the five regions for ticks (head with ears, neck and along the chest, legs including the interdigital spaces, tail and perineal region, back and abdominal regions). The entire body of the dog was then checked visually for ticks and questionnaire was filled for each dog examined. Observation of tick infestation on a dog was done by counting the number of ticks on five regions of the dog's body: (a) head with ears (b) neck and along the chest (c) legs including the interdigital spaces (d) tail and perineal region (e) back and abdominal regions. Determination of the degree of tick infestation was done based on: no ticks = (-), 1 -5 ticks (mild) = (+), 6 – 10 ticks (moderate) = (++), 11 – 20 ticks (high) = (+++), > 20 ticks (very high) = (++++).

Data analysis: Data was entered into Microsoft Excel and analysis was done using SPSS. Pearson Chi-square analysis was applied to determine individual factors associated with tick infestation. For all analyses, statistical significance was set at $P < 0.05$.

RESULTS

Characteristics of the Dogs: Of the total 130 dogs that were examined in the study, 63 (48.5%) were less than 12months old. The mean age of the dogs was 22.85±14.53 months. Based on sex, 57 (43.8%) of the dogs were male while 73 (56.2%) were females. The predominant breed of the dogs examined were German Shepherd (40.0%), Rottweiler (7.5%), Boerboel (18.3%), Mongrel breed (20.8%), Toy breed (4.2%) and Caucasian (9.2%). The major health challenge of the dogs was ticks and lice infestation 56 (43.1%). It was observed that 18 (13.8%) of dogs has no kennel / house built for them, while 76 (58.5%) of the dogs did visit veterinary hospital for routine veterinary care (Table 1).

Level of care for the dogs: A total of 107 (80%) of the sampled dogs had previous history of tick infestation. However, 23 (17.7%) of the dogs had never encountered tick on their body. Meanwhile, 98 (75.4%) of the dogs had their kennels fumigated. Of these, 42 (32.3%) do have their kennels fumigated monthly, while 9 (6.9%) of the dogs had their kennels fumigated yearly. A total of 80 (61.5%) of the dogs do go on a walk with their owners while 10 (7.7%) of the dogs had never been bathed (Table 2).

Prevalence of tick infestation on sampled dogs: A total of 73 out of the 130 sampled dogs had tick on them, making the prevalence of tick infestation to be 56.2%. The measured

severity of tick infestation rate was 29 (39.7%) had very high infestation, followed by 27 (37.0%) dogs with mild infestation, while 9 (12.3%) and 8 (11.0%) had moderate and low tick infestation, respectively.

Table 1:
Characteristics of Dogs

Variables		Frequency (n = 130)	Percentage (%)	Mean ±SD
Age (months)	<12 12-35 36-60 >60	63 36 23 8	48.5 27.7 17.7 6.2	22.85 ±14.53
Gender	Male Female	57 73	43.8 56.2	
Breeds of dog	German Shepherd Rottweiler Boerboel Mongrel breed Toy breed Caucasian	48 9 22 25 5 11	40.0 7.5 18.3 20.8 4.2 9.2	
Main Health challenge	Worm infestation Ticks and other external parasitism Infected wound Gastroenteritis Pregnancy Behavioural problem Reproductive problem	3 56 2 17 2 6 1	2.3 43.1 1.5 13.1 1.5 4.6 0.8	
Kept in kernel	Yes No	112 18	86.2 13.8	
Dog well fed	Yes No	110 20	84.6 15.4	
Routine checkup/vet care	Yes No	76 54	58.5 41.5	

Distribution of ticks based on predilection site: The most preferred site of tick attachment was the head especially inside ear and neck region among 52 dogs (71.2%). This was followed by leg and inter-digital space 36 (49.3%). Ticks were also found on back region of 30 (41.1%) dogs, while the least region where ticks were found was the abdominal region 18 (24.7%) (Table 3).

Risk factors associated with tick infestation : Degree of tick infestation has been reported (Figure 1). Result showed that there was significant relationship ($P < 0.05$) between previous history of tick found on dogs and tick infestation. However, there was no significant relationship ($P > 0.05$) between tick infestation in dogs and sex, breed, age, and location of dogs and other factors (Table 4).

Table 2:
Level of care for the dogs

	Variables	Frequency	Percent
History of tick infestation	Yes No	107 23	82.3 17.7
Fumigation of compound/kennel	Yes No	98 32	75.4 24.6
How often	Monthly Quarterly Yearly Occasionally	42 22 9 26	32.3 16.9 6.9 21.5
Dog go on a walk	Yes No	80 50	61.5 38.5
Bathing of dog	Yes No	120 10	92.3 7.7

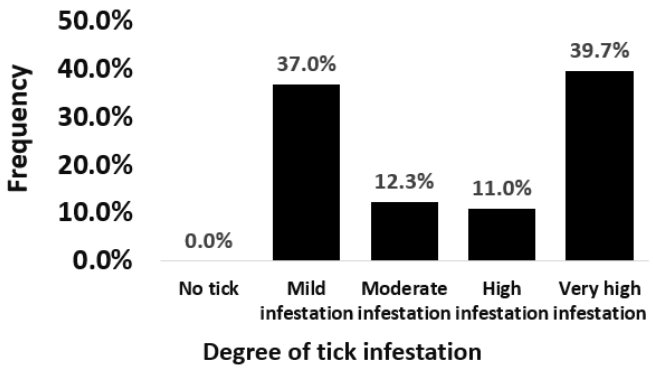

Fig 1:
Degree of tick infestation in Dogs

Table 3: Regions infested by ticks on dog's body

	Variable	Frequency	Percent
Region	Tick on dog's head to neck	52	71.2
	Tick on the dog's back region	30	41.1
	Dog's body and abdominal region	18	24.7
	Dog's leg and inter-digital space	36	49.3

DISCUSSION

This study revealed that there was relatively high prevalence of tick infestation in dogs sampled in Ibadan. The high prevalence of 56.2% from this study is very similar to the 55.4% prevalence result from Makurdi, Nigeria (Amuta and Houmsou, 2009). However, the prevalence is quite lower than a study from Ilorin and Maiduguri with 71.2% and 96.0% prevalence, respectively (Konto *et al*., 2014; Abdulkareem *et*

al., 2018). The higher prevalence from these areas could be attributed to the hot climate with average temperature greater than 30°C, which favoured tick breeding. Sequel to these reports, there is no doubt on the severe health conditions among exotic breeds with tick infestation. Outside Nigeria, prevalence of tick infestation in India, Lahore, Pakistan, Brazil, Indonesia and Ethiopia have reported 45.0%, 55.3%, 53%, 58.5%, 67.9% and 97%, respectively. The higher prevalence in Indonesia and Ethiopia could be attributed to favourable climatic conditions for tick survival, reproduction and development (Kumsa *et al*., 2019). Moreover, the preventive care of dogs against tick infestation could be minimal in some of these countries. Most long-haired breeds and cross breeds usually possessed a greater number of ticks on their body (Dipeolu, 1975), hence breed of dogs could also be a predisposing factor. This study showed similarities in findings with most of the earlier studies in and outside Nigeria.

The geographical location of the dogs showed no association with tick infestation meaning that there was no significant difference (P > 0.05) in prevalence of tick infestation among dogs located in urban, suburban and rural areas. This is in agreement with an earlier study from Chile, in which *R. sanguineus* was predominant in both rural and urban areas and that there was no significant difference in tick infestation among rural and urban areas (Abarca *et al*., 2016). Elsewhere studies reported significant increase in prevalence of tick infestation in urban areas compared to rural areas (Shimada *et al*., 2003; Neves *et al*., 2004). Meanwhile, a study from Brazil reported significant increase in prevalence of tick infestation in rural than urban areas (Costa *et al*., 2013). The cost of acaricides especially for rural dwellers on their dogs could be high and not affordable, and these could be responsible for the high prevalence of tick infestation from rural dogs (Dantas-Torres *et al*., 2009). Other contributing factors to higher prevalence include management type (e.g. rural dogs are often semi-domiciled and have free access to forested areas, predisposing them to ticks).

Based on sex, female dogs were more infested than their male counterpart, although there is no significant difference. This might be due to the fact that female dogs usually form a sedentary habit while nursing their offspring which easily make them infested with ticks (James-Rugu and Jidayi, 2004). This study also revealed that, the intensity of infestation was higher in puppies and young dogs (less than a year) which may be due to gradual acquisition of immunity and close proximity to the ground (Abdulkareem *et al*., 2018).

The head, ear and neck seemed to be the most preferred predilection sites for ticks on dogs in the study area followed by the leg and interdigital space. This corroborates earlier report that most preferred sites of tick attachment in decreasing order were head, neck and legs (Foldvari and Farkas, 2005).

Table 4:
Risk factors associated with tick infestation

		Tick infestation			
	Variable	**Yes (%)**	**No (%)**	X^2	***P*-value**
Patronize veterinarian/vet clinic	Yes	44 (77.2)	59 (80.8)		
	No	13 (22.8)	14 (19.2)	0.26	0.61
Gender of dog	Male	31 (42.5)	26 (45.6)		
	Female	42 (57.5)	31 (54.4)	0.13	0.72
Lost any dog in the past	Yes	53 (72.6)	37 (64.9)		
	No	20 (27.4)	20 (35.1)	0.89	0.35
History of previous tick infestation in dog	Yes	69 (94.5)	38 (66.7)		
	No	4 (5.5)	19 (33.3)	17.05	0.001*
Nutritional status of dog	Good	59 (80.8)	51 (89.5)		
	Poor	14 (19.2)	6 (10.5)	1.84	0.18
Nearest bus-stop	Omi/Apata	13 (17.8)	18 (31.3)		
	Apete/Jericho	4 (5.5)	3 (5.3)		
	Mokola/Dugbe	6 (8.2)	5 (8.8)		
	Oluyole	4 (5.5)	8 (14.0)		
	Bodija/UI	19 (26.0)	9 (15.8)		
	Alakia	13 (17.8)	5 (8.8)		
	Akobo	14 (19.2)	9 (15.8)	8.75	0.19
General house sanitation	Yes	62 (86.1)	49 (87.5)		
	No	10 (13.9)	6 (10.7)	1.55	0.46
Dog bathing	Yes	66 (90.4)	54 (94.7)		
	No	7 (9.6)	3 (5.3)	0.84	0.36
Fumigate kennel	Yes	57 (78.1)	41 (71.9)		
	No	16 (21.9)	16 (28.1)	0.65	0.42

X^2- Chi square, * significant at $P<0.05$

The presence of ticks in these sites could be probably due to their exposure to the questing ticks as the dog roam about. Preferences for the ears and inter-digital spaces have been earlier reported on dogs in the USA and Mexico (Tinoco-Gracia *et al*., 2009). These areas are hiding places for the ticks and are less accessible to the dog to remove them by its paws compared with locations such as the neck or the face. The low infestation observed on the head and the belly could be probably due to the exposure of these parts to environmental factors, or the fact that the ticks are often more easily seen and removed by the dog owners. *R. sanguineus* in earlier study showed preference for the ears of the dogs (Dipeolu, 1975).

General demographic characteristics of dog were found to be statistically not significant. History of previous tick infestation in dog was highly significant meaning that dogs confirmed to had been previously infested with ticks are at higher risk of being re-infected if no preventive measure is employed. Ticks are also notable due to their adaptability to live in a great variety of environmental conditions and their capability to survive for long periods of time without feeding (Dantas-Torres, 2008).

There is significant increase in tick infestation from kenneled dogs compared to free-roaming dogs. The restricted movement of dogs in the infested housing could have been responsible. A total of 82.3% were reportedly to have had history of tick infestation. Several factors could have been responsible; such as breed of dogs, routine checkup, fumigation of dog kennel and compound, dog bathing, method of tick control, level of education of dog owners, nutritional status of dogs, location, religion, marital status, knowledge of source of tick infestation and others are insignificantly associated with tick infestation on dogs.

The dogs brought to the clinics, and on which fewer ticks were found, are owned, on the other hand, by the middle class. Their dogs live in a cleaner environment and the ticks on them are frequently removed through the tick-bath in the clinic.

Tick control efforts will need to be maintained in coming years in order to keep the risk of tick bite and RMSF reduced in this community. It is unlikely that a full elimination scheme can be achieved for such a ubiquitous pest. However, adequate tick control in the environment and on animals will decrease the opportunities for human illness, and, when coupled with supportive care from well-trained physicians, cases can be caught sooner and deaths prevented (Drexler *et al*., 2014). Irrespective of the total number of ticks per dog, a high risk for contracting a tick-borne infection was demonstrated; according to the presented data, dogs have a high risk to become infected with at least one pathogen during their life. Consequently, it is mandatory to apply suitable and effective prophylactic measures against tick infestations and tick-borne infections in dogs, starting early in life (Leschnik *et al*., 2013).

In conclusion, this study confirmed that several vector-borne pathogens of humans and animals are highly prevalent in Nigeria, where the incidence of tick-borne infections appears to be underestimated. Physicians and veterinarians should be aware of the existence of these pathogens in Nigeria and should include them in the differential diagnoses for clinical illnesses with compatible clinical signs. There is a high risk for contracting a tick-borne infection as demonstrated in this study because of the high prevalence of ticks which are major vector of haemoparasites. In accordance with this study, it is highly recommended that regular and routine checkup at veterinary clinic and consultation of veterinarian should be carried out by dog owners monthly to avoid tick infestation in dogs. Routine screening of clinically ill exotic dogs for tick-borne diseases should be carried out upon presentation in veterinary clinics, while regular tick control scheme on the dogs and their living environment is advocated.

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