



Research Article

Prevalence of *Dirofilaria immitis* Infection in Dogs in Maiduguri, Borno State

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ARTICLE INFO:

Keywords:

Dogs,
Dirofilaria immitis,
Prevalence rate,
Zoonosis

ABSTRACT

Dirofilaria immitis infection is a major potential life threatening disease of dogs with worldwide distribution and of zoonotic importance. This study was carried out to investigate the prevalence of *D. immitis*. A total of 250 blood samples were randomly collected from dogs in the study area. The examination for *D. immitis* infection was carried out based on the conventional and immunological procedures using wet mount and Buffy coat methods. The total prevalence of *D. immitis* was 100 (40.00%). The prevalence of *D. immitis* in the adult dogs was 62 (24.80%) while, in the young dogs was 38 (15.20%). The prevalence of *D. immitis* in the male dogs was 54 (21.60%) while, 46 (18.40%) was the prevalence of the female dogs. The prevalence of outdoor dogs was 64 (25.60%) while, that of the indoor dogs was 36 (14.40%). The dogs with thin body condition scores had a prevalence of 80 (32.00%) while, the overweight (obese) dogs were 20 (8.00%). However, the prevalence of *D. immitis* is higher in the adult, male and outdoor dogs compared to the young, female and indoor dogs. Therefore, the present study revealed a high prevalence of *D. immitis* infection in the study area.

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INTRODUCTION

D. immitis, the heartworm of dog, is one of the most important filaroid nematodes responsible for causing *dirofilariasis* in canine species.

Heartworm infection is considered as economically important because it affects canine populations around the globe (Atkins, 2015).

According to reports, *Dirofilaria immitis* is a developing zoonosis that causes heartworm disease (Pampiglione *et al.*, 2001). Human infection has been recorded in tropical subtropical and temperate areas of the world. Presently more than 1,700 human cases of *dirofilariasis* have been documented globally suggesting that where ever canine *dirofilariasis* is present, humans are at risk of infection (Montoya-Alonso *et al.*, 2010; Simon *et al.*, 2012).

In dogs and other animals, this zoonotic parasite prefers to live in the right ventricle and pulmonary arteries (McCall *et al.*, 2008). *Aedes*, *Culex*, and *Anopheles* mosquitoes are among the species that spread the heartworm parasite. When a possible vector bites dogs or another susceptible animal during a subsequent blood meal, the infection of heartworms is spread (Genchi *et al.*, 2014).

The main manifesting clinical symptoms of the heartworm infection include difficulty in breathing, persistent cough, exercise intolerance accompanied by ascites, weight loss and anorexia (Vieira *et al.*, 2014). However, accurate diagnosis and confirmation of heartworm infection depends on serological tests and molecular tests. Laboratory diagnosis of heartworm infection is always made by demonstrating and identifying microfilaria in analyzed blood samples (Montoya-Alonso *et al.*, 2015).

Limited work has recorded the prevalence of this zoonotic parasite of dogs in Nigeria (Ogbaje and Abel-Danjuma, 2016). The level of the infections in dogs derived from the current study were specific for sex, age, breed, management practice and body condition scores where targeted dogs are more likely to be susceptible to the occurrence of the degenerative disease condition. Consequently, the goal of the current study is to assess *dirofilariasis* in dogs in Maiduguri Borno state.

MATERIALS AND METHODS

Study area

The current study was carried out in Maiduguri Borno State, which is located in Nigeria's northeast. Borno State's capital, Maiduguri, has a total area of 15.1 km² and lies between latitudes 11⁰ and 14⁰N and longitudes 10⁰ and 14⁰E with a population density of 1,738 people per square kilometer. The temperature ranges from 35-40⁰C for most part of the year with a mean annual rain fall of about 647mm (BMLS, 2007).

Study animals

A total of two hundred and fifty dogs were randomly selected for the study (135 males and 115 females) in Maiduguri and were examined for the detection of the infection. The dogs were categorized as young (less than one year) and adult (above one year) and the age was estimated by using dentition formula considering the annual layers of teeth and bone (Ohtaishi, 1985). The breed was categorized as exotic, local and crosses and management practices as outdoor and indoor. The body condition score system employed in the present study was that developed and validated by Laflamme, (1997), which categorized the dogs into poor (thin), and overweight (obesed).

Blood collection

The dogs were clinically examined and important information such as sex (male or female), age (adult or young) breeds (exotic, local or cross) management system (outdoor or indoor) and body condition score (poor, or overweight) were recorded. The dogs were properly restrained and blood was aseptically collected via cephalic venipuncture of each dog. About 5ml of blood was collected using 5ml syringe and 21 gauge needles.

Three millilitre of the blood was collected in tube containing EDTA as anticoagulant for microscopic examination and two millilitre was introduced into a non EDTA (plain) tube for

harvesting of the serum for serological technique. The samples were labeled appropriately, stored in an ice pack box, transported to the Department of Veterinary Parasitology laboratory, University of Maiduguri where they were processed.

Parasitological investigation

The investigation for *Dirofilaria immitis* infection (Heartworm infection) was carried out based on the conventional and immunological procedures. The orthodox techniques were based on the *microfilarial* accessibility in the samples of blood and this was evaluated using wet mount method as described by Byeon *et al.* (2007), Buffy coat method as described by Cheesbrough, (2010), modified Knot’s Test according to Ciocon *et al.* (2010). These approaches often show the presence or absence of the parasite.

The immunologic proof was generated using a widely marketed heartworm ELISA antigen kits for canine and was based on the detection of heartworm antigens in the analyzed blood (serum) samples (Demeditec, DE II 795) following the Manufacturer’s protocol.

Statistical Analysis

Prevalence with 95% confidence interval was used to determine the prevalence of *Dirofilaria* infection in the various age groups, sex, breed, management practice and body condition scores. Online Vassarstat for Confidence Interval of a Proportion (Newcombe, 1998) was used.

RESULTS

Table 1 showed the prevalence of *Dirofilaria immitis* infection in the various age group, sex and breed distribution.

Table 1: Prevalence of *Dirofilaria immitis* in relation to age, sex and breeds of dogs in the study area

Indices	Parameters	Number of dogs examined	Number of dogs positive/ prevalence rate (%)	95% confidence interval, lower & upper limits
Sex	Male	135	54 (21.60)	16.95, 27.11
	Female	115	46 (18.40)	14.09, 23.67
Age	Adult	155	62 (24.80)	19.86, 30.51
	Young	95	38(15.20)	11.28, 20.17
Breed	Local	145	58 (23.20)	18.40, 28.81
	Cross	60	24 (9.60)	6.54, 13.89
	Exotic	45	18 (7.20)	4.60, 11.09

Table 2 showed the prevalence of *Dirofilaria immitis*, with respects to management practices and body condition scores (BCS).

Table 2: Prevalence of *Dirofilaria immitis* in relation to management practices and body condition scores in the study area

Indices	Parameters	Number of dogs examined	Number positive prevalence rate (%)	95% confidence interval, lower & upper limits
Management practice	Outdoor (stray)	160	64 (25.60)	20.59, 31.35
	indoor (owned)	90	36 (14.40)	10.59, 19.29
Body Condition Scores (BCS)	Thin	200	80 (32.00)	26.53, 38.02
	Overweight	50	20 (8.00)	5.24, 12.03

DISCUSSION

It is crucial to evaluate the relationship between canine heartworm infection and the various age groups, sex, breed, management systems, and physical condition scores of the dogs in Maiduguri, a semi-arid location in North Eastern Nigeria. This is important because the study will be of great benefit to both dogs and humans for effective control and preventive measures of this zoonotic disease.

The present study showed higher prevalence in outdoor (stray) dogs than indoor (owned) dogs. The record of higher prevalence in homeless dogs is probably caused by their propensity to move freely, which makes them more susceptible to mosquito bites from various mosquito species. This finding agrees with previous work done by Bhattacharjee *et al.* (2014) who also recorded a higher prevalence in stray dogs.

There was also higher prevalence rate of positive cases in older dogs than in young ones. This agrees with previous reports by Ugochukwu *et al.* (2016) and Ogbaje and Abel-Danjuma (2016), who all reported higher prevalence rates of infection in older, male and outdoor dogs. This may likely be

attributable to the long incubation period of the worm.

The higher prevalence rate of infection recorded in male dogs could be attributable to the exploratory life style of male dogs. The highest prevalence rate of infection seen using the ELISA Kit and wet mount techniques in the present study, could be as a result of occult infection. This is a condition where microfilariae are absent in the canine heartworm-infected blood in circulation.

Occult infection (*amicrofilaraemic* infection) might be caused by a number of factors, including minimal parasite levels, young adults' pre-existing infections, geriatric female worms, solely male worms infecting dogs, and the host's immune function to microfilariae. Occult infection cases have been previously reported by Lai *et al.* (2001) and Yildiz *et al.* (2008).

In the current investigation, breed was taken into consideration as a potential variable input. The local dogs had the highest rate of heart worm infection when compared to the crosses and exotic. This may be probably because owners of the local dogs do not carry out routine heartworm chemoprophylaxis when compared to the owners of exotic breeds of

dogs that carry out routine chemoprophylaxis against heartworm.

The rate of heartworm infection was seen highest in the thin body condition scored dogs than in the overweight body condition scored dogs. This finding was in accord with the findings of Siwila *et al.* (2015) and Eisenman *et al.* (2021). Additionally, the variations seen within the body condition scoring group may be related to recent eating history, organizational techniques, or antibiotic use (Manyi-Loh *et al.*, 2018).

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CONCLUSION

Based on the result of the present study, dirofilariasis exists and is prevalent among dogs in Maiduguri Metropolis, North Eastern Nigeria. High prevalence rate was recorded in males, adults, stray and dogs with poor body condition scores. Also, the prevalence of *Dirofilaria immitis* infection in Maiduguri should be an alert to physicians and the general public on the risk of this zoonotic disease as infection to humans.

CONFLICT OF INTEREST

The authors have declared no conflict of Interest.

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