The Journal of Animal & Plant Sciences, 29(2): 2019, Page: 431-436
ISSN: 1018-7081

ZOONOTIC POTENTIAL OF ANCYLOSTOMOSIS AND ITS PREVALENCE IN STRAY AND PET DOGS OF LAHORE METROPOLITAN

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ABSTRACT

The present research was intended to appraise the prevalence rate of Ancylostomosis in dogs and its potential risk for human beings. The exploration was carried out at Lahore to define the prevalence and zoonotic potential of the Ancylostomosis. The metrological data (temperature, humidity & rain fall) was collected from the Metrology Department, Government of Pakistan, Lahore during the time of study. Out of 600 stray and pet dogs under study, 133 (22.16%) were found positive. The prevalence during the summer and winter was found 31.0 % and 15% respectively ($p< 0.05$). In pups prevalence was found more as compared to adult dogs. Moreover, both females (38.9%) and males' pet owners (39.8%) seem to have an equal chance for contracting this disease. The disease was more prevalent in Nasir Bagh Park (36.9%). The prevalence of L3 larvae of *A. caninum* was recorded high (22-30%) during summer and rainy season in different public parks under study. The investigation clinched that high infection rate was found in the summer season succeeded by monsoon and the least in winter.

Key words: Prevalence, Dog, Zoonosis, Ancylostomosis, Lahore.

INTRODUCTION

Intestinal parasites are among the most common pathogenic agents encountered by veterinarians dedicated to companion animals. They constitute one of the main causes of pathologies of the intestinal tract in dogs. Keeping this point in view, some of the dog parasites, such as *Ancylostoma* (*A.*) spp. and *Toxocara (T.) canis* are considered to have a substantial public health concern, particularly in different communities and low income countries that are socioeconomically deprived. In these societies, overcrowding and poor hygiene conditions, together with the lack of zoonotic awareness and limited veterinary attention, increase the chances of disease transmission (Craig and Macpherson, 2000: Bradbury *et al*. 2017).

Ancylostomosis (hookworm disease) is bestowing worldwide and zoonotic in nature. The *Ancylostoma caninum* parasitizes dogs throughout the subtropics and tropics, as well as considered to be most widespread of all hookworm species. Due to its zoonotic importance and above high prevalence, *A. caninum* has attained vital significance in public health research and in veterinary field. In recent years, the apprehension that *A. caninum* causes human gut diseases hence sparked off interest in its zoonotic potential (Obiukwu and Onyali, 2006).

Ancylostomosis arises in temperate and warm climates, specifically in that environment where there is adequate moisture. *Uncinaria stenocephala* and *A. caninum* infections are comparatively common in pups, although the former is much more frequent (Krishnabhanu and Vardhani, 2013: Li *et al*. 2014: Liu *et al*. 2015: Ana *et al*. 2018). The most pathogenic specie of all hookworms in pet animals is *A. caninum*. The primary clinical signs of Ancylostomosis include loss of appetite, progressive anemia, oedema of dependent parts, emaciation, hemorrhagic diarrhea and death (Lamb *et. al*. 2012). The pet and stray dogs play a key role in disease transmission, although in each population precise implication are not clearly recognized. The transmission of zoonotic helminth scan occurs via indirect or direct contact with infected water and food (Aguilar *et al.* 2005: Rehman, *et al*. 2017: Ana *et al*. 2018).

The present study was conducted to derive, over all prevalence of Ancylostomosis in and around the University of Veterinary & Animal sciences as well as nearby vicinity of Lahore keeping in view the metrological data of different month, season, age and sex. The essential prophylactic measures to be adopted to rescue the human beings from the disease and shielding dogs from hookworm infection.

MATERIALS AND METHODS

The study was carried out at Lahore, capital city of province Punjab, to determine the overall prevalence rate of Ancylostomosis in dogs. The time period of the investigation was 12-month from August 2015 to July 2016. The metrological data (temperature, humidity) was collected from the Metrology Department, Government of Pakistan, Lahore during the time of study.

A total of 600 fecal samples were collected round the year from dogs that were brought for treatment

to the Pet Center, Department of Clinical Medicine and Surgery, University of Veterinary and Animal Sciences, Lahore. Signalement and history of each study animal was recorded on pre-designed proforma. After collection of faecal samples aseptically, coprological examination was done by a method called modified McMaster technique (Levine *et al*. 1960: Soulsby, 2005). The season, age, sex wise and overall prevalence in dogs were studied during the period.

Zoonotic potential of this parasite was determined by examining the possibility of disease transmission in human i.e. 1) soil samples of various parks and greenbelts/foot paths of Lahore City and the lawns of pet owners for the presence of larvae of Ancylostomes and 2) prevalence of ancylostome ova in the fecal samples of pet owners and those individuals that frequently visited the above mentioned public parks of Lahore City.

To check the prevalence of L3 larvae of Ancylostomes, approximate 120 soil/grass samples were taken from five public parks of the study area (Nasir Bagh, Bagh-a-Jinnah, Ghulam Jillani Park (Race Course Park), Gulshan-a-Iqbal Park, Iqbal Park (Minto Park), two green belts/footpath (Bhatti Gate and Chouburji Centre) and the home gardens of pet owners. The soil/grass samples were processed for the presence of L3 larvae by using a Harada Mori filter strip culture method (Levine *et al*. 1960: Soulsby, 1982).

Statistical Analysis: The prevalence data was statistically analyzed by using Chi square ($\chi 2$) test. IBM SPSS 20.0software was used for applying $\chi 2$ test (Steel & Torrie 1997).

RESULTS

The data regarding temperature, humidity and rain fall of the study period was collected from Department of Meteorology, Government of Pakistan. In August, 2015, the mean minimum and maximum temperatures were 28.9°C and 38.9°C respectively. The total rainfall during the year 2015-2016 was 872.4 mm³.The highest rainfall was recorded in June, 2016 followed by September (198.6 & 158.4 mm³ respectively).The humidity was higher in February and December.

Table 1. Monthly mean maximum and minimum temperatures, Rain Fall and Humidity of Lahore City during the year 2015-2016.

Month	Temperature (°C)			Mean Humidity (%)	
	Mean Maximum Temperature	Mean Minimum Temperature	Rain Fall (mm³)	08.00 a.m.	05.00 p.m.
Aug. 2015	38.9	28.9	146.7	78	68
Sep. 2015	36.4	26.9	158.4	74	56
Oct. 2015	32.8	22.8	47.8	72	50
Nov. 2015	23.8	18.2	09.6	82	56
Dec. 2015	21.6	10.8	31.2	86	58
Jan. 2016	20.8	08.6	01.8	80	42
Feb. 2016	21.6	12.8	102.6	88	62
Mar. 2016	24.6	16.6	68.4	76	46
Apr. 2016	37.8	23.9	01.8	48	24
May. 2016	39.8	28.2	20.6	44	26
Jun. 2016	46.4	28.6	198.6	58	42
July. 2016	38.6	26.8	84.8	78	60

Prevalence of Ancylostomes: The prevalence was recorded in both pets and stray dogs when the faecal samples were processed for the identification of ova.

i) Pet dogs: During the period of study, dogs examined (n=600), 133 (22.16%) were found positive for Ancylostomes, while 24.50% of dogs were infected with other helminthes (Table 3). The Ancylostomes was more ($p < 0.05$) abundant in Summer Season as compared to winter season (Table 2). There was a significant difference regarding the prevalence of Ancylostomes parasites in dogs of different age groups. The parasites were more prevalent (Chi square; $p< 0.05$) in young dogs (01-06 Month) compared to older dogs (Table 3). Similarly, helminthes other than Ancylostomes were more abundant in dogs of 7-11 months old. The parasites was more prevalent in male dogs (21.03%) compared to female dogs (20.15%) (Table 4).

Table 2. Comparison of prevalence of Ancylostomes and other helminths in dogs based on different seasons.

Season	Ancylostomes		Other helminthes	
	Positive	Prevalence (%)	Positive	Prevalence (%)
Summer (n =200)	62	31	88	44
Winter (n = 200)	30	15	24	12
Total (n = 400)	**92**	**23**	**112**	**28**

Table 3. Comparison of prevalence of Ancylostomes and other helminths based on different age groups.

Age groups	Ancylostomes		Other helminthes	
	Positive	Prevalence (%)	Positive	Prevalence (%)
01-06 month (n = 180)	51	28.33	55	30.55
07-11 month (n = 120)	38	31.66	37	30.83
01-06 years (n = 190)	28	14.73	35	18.42
>06 years (n = 110)	16	14.54	20	18.18
Total (n = 600)	**133**	**22.16**	**147**	**24.50**

Table 4. Comparison of prevalence of Ancylostomes and other helminths in male and female dogs.

sex groups	Ancylostomes		Other helminthes	
	Positive	Prevalence (%)	Positive	Prevalence (%)
Male (n =347)	73	21.03	92	26.51
Female (n = 253)	51	20.15	54	21.34
Total (n = 600)	**124**	**20.66**	**146**	**24.33**

II. Prevalence in Human beings: Zoonotic potential of this parasite was determined by examining the possibility of disease transmission in human. Prevalence found to be 28.33% & 23.33 % in home gardens and parks respectively (Table 5). Difference in strength was calculated on the basis of gender as the prevalence of Ancylostomes was comparable ($p > 0.05$) between male (39.8%) and female (38.9%) in pet owners.

Table 5. Comparison of prevalence of Ancylostomes larvae in different parks, green belts and home gardens of Lahore City.

Green belts	Larvae of Ancylostomes	
	Positive	Prevalence (%)
Parks (n = 600)	140	23.33
Green belts (n = 240)	54	22.50
Home gardens (n = 120)	34	28.33

Table 6.Cumulative prevalence of Ancylostomes in pet owners based on different age Groups.

Age groups	No. of samples	Ancylostomes	
		Positive	Prevalence (%)
5-10 years	86	44	51.16
10-25 years	80	28	35.00
>25 years	84	20	23.80
Total	**250**	**92**	**36.8**

Age related variation was noted for the prevalence of Ancylostomes in the faecal samples of visitors. The prevalence was statistically significant ($p < 0.05$) in the children compared to adults. In children (5-10 years old), the ova were found more frequently ($p < 0.001$) (Table 6).

The Prevalence of disease in human beings especially in kids is suggestive of the zoonotic potential of the malady which may be due to, either by interaction with the dogs i.e. playing in home gardens / parks or by other vectors containing the contaminated soil.

DISCUSSION

Pets offer significant benefits to our society. However, they got infected with bacterial, viral, fungal or parasitic diseases, and can be a source of infections for humans (Plaut *et al*., 1996; Geffray, 1999). The potential health risk to humans due to enteric parasites, harbored by pet dogs and cats, remains a significant problem in most parts of the world (Schantz, 1994).

Numerous surveys have been conducted in countless areas of the world to examine the prevalence rate of various intestinal parasites in dogs such as in Mexico (Aguilar *et al*., 2005), Venezuela (Ramırez-Barrios *et al*., 2004), South Africa (Minnaar *et al*., 2002) and in Hungary (Fok *et al*., 2001).These studies display base line awareness of parasitic infections on an indigenous level. Majority of authors evaluated parasite prevalence association in dogs in relation to gender, age and breed, but some researcher's also focused on diversity index and seasonal variations for further comprehensive analysis (Oliveira-Sequeira *et al*., 2002; Aguilar *et al*., 2005). These studies revealed variation in the results attributable to various environmental factors, geographical variation, species composition and other stress factors involved in parasite transmission.

The overall prevalence rate found was 22.16% (133/600) in this study, which has similarity with the prevalence rate of Ancylostomosis detected through the fecal examination of dogs by Jani *et al.* 1995(26.9%), Oliveira-Sequeira *et al.* 2002(23.6%), Ramirez *et al.* 2004(24.5%), Singh *et al.* 2011 (19.32%), Qadir *et al*. 2011 (17.84%) and Gugsa *et al*. 2015(24%). However, the results of this study are higher than that of Godara *et al.* (2010) which is comparatively low (13.30%). The prevalence rate of *A. caninum* in feces in our study is also much greater (22.16%) as compared to the rate (3.22%) found in contaminated soil by Ali *et al.* 2013 which may be due to the data collected in different seasons (throughout year and from different type of places i.e. Home gardens, Green belts & Parks) .

As for as seasonal prevalence of Ancylostomosis is concerned, it was found highest in summer (31%) followed by winter (15%).These findings were similar with those found in the study conducted in Anand district of Gujrat, India by Nilima *et al*. 2015. High prevalence in summer may be due to relatively more rainfall and higher environmental temperature as both temperature and humidity are important factors in the release of Larvae from the eggs (Mitra *et al.* 1990). Higher Temperature errands the development of eggs of hookworm and subsequently development of the third stage infective larvae as well as the bionomics of hookworm larvae.

Almost similar rate of prevalence for Ancylostomosis was found in both sexes (Male 21.03% and Female 20.15%) in the present study. This is not in accordance with the studies conducted by Mitra *et al*. (1990) and Oliveira-Sequeira *et al.* (2009) in which high prevalence was recorded in adult males as compared to that in adult females may be due to the different pathophysiology of worms in the two genders (Schmidt *et al*. 2016).

The prevalence of Ancylostomosis during first year of life was much higher. However, later on it gradually decreased with an increase in age. Similarly, Sowemimo and Asaolu (2008) conducted a survey to determine prevalence of *Ancylostoma* spp. in dogs of age Group ranging 0-6 months, which shows highest prevalence of *Ancylostoma* spp. in young age dogs and our results are in agreement with them. However, the results were not in coherence with those of Das *et al.* (2009) who reported that the hookworm infections were common in the age group of 2 months to 6 years (26.48%) in pet dogs could be due to lower immunity in young pups and trans-placental infection as well as trans-mammary transmission of *Ancylostoma* eggs (Lefkaditis 2001; Ramirez-Barrios *et al*. 2004) as well as poor sanitary conditions and contamination of soil (Parks, Gardens & Green belts) with infected faces. Upgrading the sanitary conditions and education of dog owners may condensed the prevalence of *Ancylostoma spp*. in dogs as well as regular treatment of pets may prevent potentially more severe outbreak of the zoonosis as by Olivera *et al*. (1990)

Control of human infections sling on liable pet ownership. Dogs should be scanned periodically for intestinal parasites and recommended anthelmintic drugs on a regular basis. Pet owners should not permit their dog's feces to accumulate in the lawn or garden (disposed of in a good sanitary way). Education and awareness concerning intestinal parasites and their effects on the health of both their pets and family members may be organized.

Conclusion: Present project exhibit that the incidence of *A. caninum* is increased in the summer season than winter season. This may be due to the optimum humidity & temperature required for growth of eggs and third stage infective larvae set up in summer season. These ambient necessities favor the bionomics of hookworm larvae. As per the age group is concerned, old age group also have decreased rate of infection compared to young ones due to their good immune status comparing the later. We recommend that development of preventative chemotherapy in the absence of concurrent hygiene and animal health programs is a probable causal factor for the advent of this zoonosis. Responsiveness must be focused to the effects of hookworm infections on human health, and a One Health slant should be implemented for the control of this zoonosis

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