Investigation on *Toxocara* spp. eggs in hair coat of dogs in YSR Kadapa district of Andhra Pradesh, India

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Abstract Present study was aimed to record the *Toxocara* spp. eggs in dog's hair and to analyze the incidence in breed and age wise along with incidence variations in the anatomical locations of hair over the body. Dogs presented to the hospital were screened for enteric parasitic ova and hair samples were collected from the different body regions including head and neck region, ventral and lateral abdomen, perianal and hindquarters and tail region. Out of the 236 dogs, 124 (52.54%) dogs showed *Toxocara* spp. eggs in the faecal samples and 60 (25.42%) showed the presence of *Toxocara* spp. eggs on their hair. It was noticed that the dogs with long hair showed (36.73%) more incidence than the short hair breeds (17.39%). The incidence of the *Toxocara* spp. eggs were varied with the presence of the hair at different anatomical locations and it was 36.67% in the head and neck region, 51.67% ventral and lateral abdomen, 86.67% in perianal and hindquarters, 56.67% in the tail region. 25.35% of the dogs were under 1-year-old, 25.98% dogs were between 1 and 6 years old and 23.68% dogs were more than 6 years had the *Toxocara* spp. eggs in their hairs. In conclusion, the presences of *Toxocara* spp. eggs in the hair of different breeds of dogs were recorded in the present geographical location and it is a zoonotic alert for the pet owners.

Keywords *Toxocara* spp. · Dogs · Zoonoses · Hair

Introduction

Toxocara spp. parasites are one of the important zoonotic nematode parasites found in the animals including in humans. It was reported in different species of animals including herbivores and carnivores. In cattle, it causes intestinal obstruction due to the presence of adult worms within the intestines (Reddy and Sivajothi 2017) in dogs, it causes gastritis and enteritis (Sivajothi and Reddy 2018) and in humans it causes ocular and visceral larvae migrans by invading the tissues (Amaral et al. 2010). Contamination of the food, water, soil and the ingestion of raw meat or improperly cooked meat or liver of domestic animals are considered as the source of infection for the humans (Wolf and Wright 2003). Pet animals play an important role in the zoonosis by the contamination of the premises with faecal parasitic ova. Recent studies revealed that the contamination of the embryonated eggs are a source of infection to the humans and it is due to environmental contamination and contact with the contaminated hair of infected dogs (Keegan and Holland 2013). Throughout the world, different studies are carried out and reported the presence of both unembryonated and embryonated eggs of *Toxocara* on the hair of different dogs (Oge et al. 2013; Sowemimo and Ayanniyi 2016; Rojas et al. 2017). In Indian literature, the incidence of *Toxocara* spp. eggs over the hair of dogs was limited. By considering the zoonotic importance of *Toxocara* spp. infection the present study was conducted to investigate the presence of *Toxocara* eggs on the hair of domestic dogs.

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Materials and methods

The present investigation was carried out from September 2015 to August 2016 at College of Veterinary Science, Proddatur, YSR Kadapa district, Andhra Pradesh, India. Dogs presented to the hospital were selected randomly and collected the clinical samples including faeces and hair for laboratory analysis. Hair samples were collected from the different parts of the body including head and neck; ventral and lateral abdomen; hindquarters and perianal region; tail region. Hair was examined immediately under the microscope for the presence of parasitic ova. The intensity of the eggs of *Toxocara* spp. on the dog hair expressed as a percentage at the different anatomical location of hair. Age and breed wise incidence of *Toxocara* spp. eggs were recorded. Percentage of the presence of *Toxocara* eggs was recorded in different age groups was classified into three groups young (below 1 year), adults (from 1 to 6 years) and geriatric (above 6 years). Dogs with long-haired breeds were in one group and another group consists of short-haired breed dogs. Microscopic examination of the *Toxocara* spp. eggs were done according to the standard morphology and according to the previous literature (Oge et al. 2013; Sivajothi and Reddy 2018). All the dogs in the present study were owned by the owners and the full consent and cooperation of the owners were obtained prior to the study. Present study was carried out on the clinical case presented to the hospital so, approval of the institutional animal ethical committee is not required and stated that no animal was harmed during the study.

Result and discussion

Out of 236 dogs examined, 124 dogs (52.45%) found positive for the *Toxocara* spp. eggs in faecal examination. Hair samples were collected from the 124 dogs and 60 dogs (25.42%) found to be positive for the presence of the *Toxocara* spp. eggs on hair samples (Figs. 1, 2). 36.73% of the long hair breed dogs and 17.39% of the short hair breed dogs showed the presence of *Toxocara* spp. eggs on hair. The incidence of *Toxocara* spp. eggs on the hair were varied from the anatomical location and it was noticed 36.67% of the dogs had on head and neck region, 51.67% of the dog had on ventral and lateral abdomen region, 86.67% of the dogs had on perianal and hindquarters region and 56.67% of the dogs on the tail region. It was recorded that, the incidence of *Toxocara* spp. eggs on the hair were noticed in 25.35, 25.98 and 23.68% of the dogs under 12 months, dogs between 1 and 6 years and dogs more than 6 years respectively. Details were mentioned in Tables 1, 2, and 3. Recorded data is supported by the other

Fig. 1 Microscopic examination of the skin scrapings—presence of the *Toxocara* spp. eggs ($\times 100$)

Fig. 2 Microscopic examination of the skin scrapings—presence of the *Toxocara* spp. eggs ($\times 400$)

Table 1 Incidence of *Toxocara* spp. eggs in different anatomical locations in dogs

	Anatomical location of hair	Number of positive	Positive percentage
1	Head and neck	22	36.67
2	Lateral and ventral abdomen	31	51.67
3	Hind quarter and perianal region	52	86.67
4	Tail region	34	56.67

studies in abroad (Amaral et al. 2010; Keegan and Holland 2013; Sowemimo and Ayanniyi 2016) who found the contamination of dog hair with *Toxocara* spp. eggs at different stages of development. By the nature of the thick shell wall of the *Toxocara* spp. eggs, they may survive for a long time on soil and on the hair of dogs up to the favourable conditions (Macpherson 2013).

Table 2 Incidence of the *Toxocara* spp. eggs in dogs with different age group

	Different age groups	Number of dogs examined	Faecal sample examination		Hair sample examination	
			Number of positive	Percentage	Number of positive	Percentage
1	Below 1 year	71	42	59.15	18	25.35
2	1–6 years	127	66	51.96	33	25.98
3	Above 6 years	38	16	42.10	9	23.68

Table 3 Incidence of the *Toxocara* spp. eggs in different breeds of dogs

	Different breeds	Number of dogs examined	Faecal sample examination		Hair sample examination	
			Number of positive	Percentage	Number of positive	Percentage
1	Long hair coated dogs	98	51	52.04	36	36.73
2	Short hair coated dogs	138	73	52.89	24	17.39

The recorded findings in the present study suggested there is no age-specificity in the prevalence of parasitic eggs on the hair of dogs. But in the previous literature, difference was noticed in young animals and it might be due to more prevalence of faecal parasitic ova due to transuterine and transmammary transmission in young animals. Adult's dogs may have more prevalence during their lactation period by the activation of adult worms. Most of the dogs with long hair coat showed the more prevalence of eggs on hair than the short hair-coated dogs. Anatomical distribution of the parasitic eggs was recorded highest number on the hind quarter and perianal region followed by tail region. Most of the dogs had the behaviour of rolling, it might be a responsible factor for contact with the soil. It is advisable that tail region also had a number of parasitic ova which had significance during the disease transmission to the public.

In this study, two types of eggs including embryonated and unembryonated were noticed. But in the previous literature, only embryonated eggs were noticed (Keegan and Holland 2013). It is proposed that during the life cycle, under the suitable environmental conditions unembryonated eggs developed into infective stages. The presence of embryonated eggs on the hair of dogs is a great risk factor for the disease transmission. Literature was available on the transmission of the *Toxocara canis* eggs by soil contamination to the humans (Lee et al. 2010; Keegan and Holland 2013). In the present study, another alternative route of transmission is contacting with the dogs with hair with embryonated *Toxocara* eggs and it is a self-contamination phenomenon for the infected dogs. In conclusion, it is advised that education of the owners is very essential to prevent recurrence and environmental contamination. The present study also recommended regular deworming and

continuous grooming inessential to the pet animals to prevent contamination of hairs.

Conclusions

Most of the dogs with gastrointestinal *Toxocara* spp. eggs showed the presence of eggs on hairs and it is a zoonotic alert for the pet owners.

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Author's contribution Both the authors had equal role for the study.

Compliance with ethical standards

Conflict of interest All the authors declare that there is no conflict of interest regarding publication of the article.

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