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Zoonotic Importance and Prevalence of *Toxocara* spp among Pets in Tripoli, Libya

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ABSTRACT

Background and Purpose: *The pets are increasingly considered a member of the family, physical contact is very common and a diverse range zoonotic infections, including parasitic, bacterial, fungal and viral diseases are capable of being transmitted from dogs and cats to humans by direct contact with them. Studies on dog and cats endoparasites in Tripoli, Libya are limited and very little information is available about the prevalence and risk factors associated with parasites occurrence. This information is important in evaluating and recommending parasite control measures in companion animals health and welfare programmes. Hence this cross-sectional study was conducted to determine the prevalence of Toxocara spp in faecal samples of owned dogs and cats. Demographic data on age, gender, breed and purpose deworming status among pets in Tripoli, Libya was also taken.* ***Methods:*** *Study was carried out in the period from 4th of October 2009 to 18th of April 2011, 73 dogs and 51 cats from different localities in study area, were investigated. The animals were examined during their visits to private and governmental veterinary clinics for routine procedures such as check-up or vaccination. All animals were subjected to clinical examination and their general condition were evaluated. A structured questionnaire was designed to gather information on pet ownership, management and related risks. The faecal samples were collected from all investigated pets, then processed and examined by qualitative floatation coprological analysis, as described in the literatures. Egg identification was based on morphological characteristics (shape and structure of shell) and measurements.* ***Results****: The overall prevalence of Toxocara canis was 15% in the dogs, meanwhile 3.9% of the cats were infected with Toxocara cati. Moreover the prevalence in dogs subjected to a deworming regimen was 6%. Whereas the prevalence in cats subjected to a deworming regimen was 0%. The findings revealed that there is no significant statistical association between the gender and breed with the infection in both dogs and cats. The age of the dogs had a considerable influence on prevalence, with a much higher proportion of younger dogs (1 - 6 months old) being infected.* ***Conclusion:*** *Considering the zoonotic potential of the estimated parasite species, the results are very important for public health. The priorities of preventive strategies include the awareness of society and in particular pet owners consisting of avoid contamination of the environment with Toxocara spp eggs is recommended, and also the close collaboration between the veterinary and human health services. Other studies are required to assess the efficacy of applied antiparasitic drugs, as well as to the indiscriminate use of broad spectrum anthelmintics must be challenged before serious parasite resistance in dogs and cats becomes common place.*

Keywords: ***Zoonotic; pets; prevalence; Toxocara spp; faecal samples; Tripoli, Libya.***

INTRODUCTION

The close relationship of people to their companion animals, recognised as a fruitful relation known as the human-animal bond [1]. Pets, particularly dogs (*Canis familiaris*) and cats (*Felis catus*) play an important role in societies throughout the world, contributing to the physical, social, and emotional development of children and well-being of their owners particularly elderly people, as they reduce diseases caused by stress [2]. Although pets offer significant benefits to our society, there are well-documented health hazards associated with owning them [3,4]. As pets are increasingly considered a member of the family, physical contact is very common and a diverse range zoonotic infections,

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including parasitic, bacterial, fungal and viral diseases are capable of being transmitted from dogs and cats to humans by direct contact with them, their exudates or excrements especially children who keeps their pets so close to them even in beds [5, 6, 7, 8, 9]. Zoonoses involving parasites are both common and important, some causing serious diseases [10]. Dogs are associated with more than 60 zoonotic disease, the most important parasitic of them is echinococcosis and toxocariasis [11].

Human toxocariasis (*toxocara*l larva migrans) has been reported to be the most common zoonotic parasitic infection caused by the ascarids of dog and cat: *Toxocara canis* and *T. cati*, respectively. Dogs and cats are considered to be the constant source of human infection [12, 13, 14] as both live in close contact with humans. Moreover, soil contaminated with defecation of street dogs and cats is everlasting continuous source of worm infection in human population [15,16]. This is more common in children who often practice pica [17,18]. Paratenic hosts, such as man and small rodents, can infect themselves unintentionally by swallowing infective eggs [19]. Two distinct forms of disease are commonly recognised in humans: visceral larva migrans (VLM) and ocular larva migrans (OLM). A third condition has been associated with toxocariasis, involving chronic weakness, allergic symptoms, abdominal pain and mild hyperesinophilia, even in areas where exposure to infection is common [20]. Diagnosis and treatment of VLM and OLM are difficult.

To our knowledge, studies concerning the prevalence and public health importance of gastrointestinal parasites in pets are sparse in Libya. Understanding the epidemiology of zoonotic parasitic infections is important for the minimization of risk to humans. The present study was conducted to determine the prevalence of *Toxocara* spp among household dogs and cats in Tripoli, Libya; and to identify the risk factors for toxocaral infestation within these pets populations.

METHODOLOGY

Study Area and study population

A cross sectional coprological study was conducted between 4th of October 2009 and 18th April 2011 in from different localities in Tripoli area (32° 54' North latitude and 13° 11' East longitude). A total of 124 faecal samples consisting of 73 owned dogs (58.87%) and 51 owned cats (41.13%) were collected. The animals of study area were examined during their visits to private and governmental veterinary clinics for routine examination and animal vaccination, general health check or without specified reason. Tables 1 and 2 describes the number and characteristics of examined dogs and cats, respectively.

Table 1: *Describe the number and characteristics of investigated dogs*

Breed	**Gender**		**Age interval (months)**				**Use of anthelmintics**		**Total**
	male	**female**	**1-6**	**> 6-18**	**> 18-48**	**> 4-8**	**used**	**Not used**	
German shepherd	20	17	9	9	11	8	27	10	37
Local	6	3	2	2	3	2	2	7	9
Hybrid	1	5	1	2	2	1	1	5	6
Rottweiler	6	1	2	1	3	1	7	-	7
Pit bull	2	2	1	--	3	--	4	-	4
Labrador	2	1	--	--	--	3	3	--	3
Boxer	--	1	1	--	--	--	1	--	1
Chihuahua	2	2	1	2	1	--	3	1	4
Dobermann	1	--	--	--	--	1	1	--	1
Black jack	1	--	1	--	--	--	1	--	1
Total	**41**	**32**	**18**	**16**	**23**	**16**	**50**	**23**	**73**

Table 2: *Describe the number and characteristics of investigated cats*

Breed	**Gender**		**Age interval (months)**				**Use of anthelmintics**		**Total**
	male	female	-6	> 6-12	> 12-24	> 24	used	Not use	

								d	
Local	4	18		10	7	2	11	11	22
Siamese	4	7		4	2	2	9	2	11
Persian	9	9		5	5	4	11	7	18
Total	**17**	**34**	**0**	**19**	**14**	**8**	**31**	**20**	**51**

Collection of faecal samples

They were collected directly from the rectum by spatula/faecal swabs or from the ground after recent defecation using gloved hands. (The latter only if the animal was seen passing the faeces). This was to avoid contamination due to presence of free living nematodes, single samples were collected from each animal. Figure 1 shows collection of faecal sample from examined dog (A) and cat (B).

Immediately after collection, the samples were then transported in a cool box to the clinical pathology laboratory in the department of Veterinary Pathology-University of Tripoli. For preserving the samples, sodium acetate-acetic acid-formalin (SAF) fixative solution 3:1 was used until examination.

Figure 1: Shows collection of faecal sample from examined dog (A) and cat (B).

All animals were subjected to clinical examination and their general condition were evaluated. A structured questionnaire was designed for the purpose of this research and administrated to pet owners regarding their awareness about the zoonotic risk to human from dogs and cats, and to gather information on demographic data such as age, gender, breed and management data like; frequency of contact with other dogs and cats, anthelmintic history, and consumption of raw or uncooked meat, etc. The information obtained from the questionnaire was necessary in order to establish the potential risk factors for parasitism in dogs and cats.

Processing of samples

In the present survey the processing of samples and identification of *Toxocara* spp eggs was performed according to standard floatation technique as described by Zajac *et al.*, [21] with the use of zinc sulfate solution as floatation fluid. The eggs of *Toxocara* species were identified morphologically by microscopy with reference to Soulsby [22]. The result was considered as positive when at least one parasite egg is present.

Statistical analysis

The prevalence was calculated for *Toxocara* infection in both dogs and cats. Association between parasitism and host and management factors were initially made using univariate analyses of odds ratios and their 95% confidence intervals, the Chi-square test (χ^2) for independence or the analysis of variance. Associations between host factors (age, gender, and breed), use of

anthelmintics, and parasitic infection were evaluated for all dogs and cats sampled. Multivariate logistic regression was then used where data were substantial enough to quantify the association between the presence of toxocariasis and host and management variables after adjusting for other variables. Only variables significant at $P<0.05$ in the univariate analysis were considered eligible for inclusion in the multiple logistic regression analysis. Backward stepwise elimination was used to determine which factors could be dropped from the multivariable model. The goodness of fit of the model was assessed with the Hosmer-Lemeshow statistic. The data were analyzed and statistical comparisons were performed using SPSS (SPSS for Windows, Version 17.0, Rainbow Technologies), and Excel 2007 (Microsoft).

RESULTS

A total of 124 faecal samples of pets comprised from 73 household dogs and 51 household cats were screened for *Toxocara* infestation. The ova were identified under the microscope by their spherical appearance with thin outer shell and slight depression, as shown in Figures 2 (A and B).

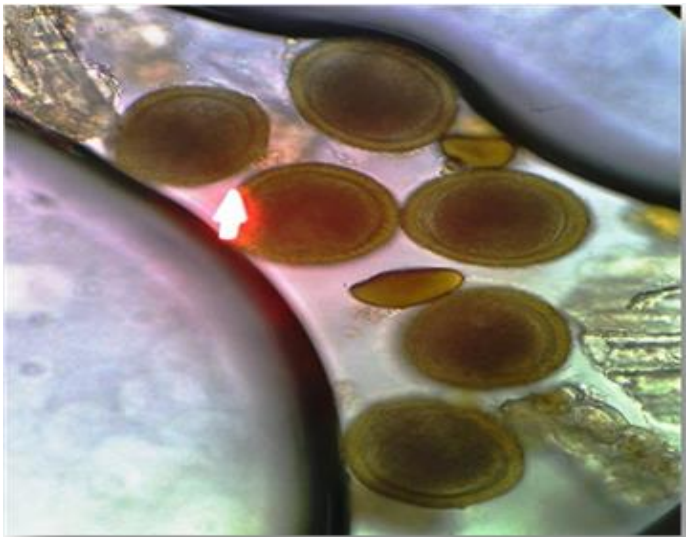

Figure 2 (A): Show eggs of *Toxocara canis*.

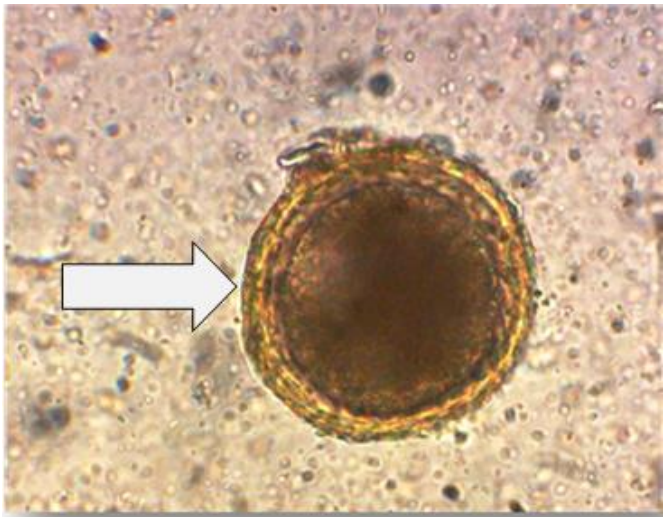

Figure 2 (B): Arrow point to single egg of *Toxocara cati*.

Of the dogs examined in this study 11 (15%) were infected with *T. canis*, and of the cats examined in this study 2 (3.9%) were infected with *T. cati*, as shown in Table 3.

Table 3: Describe the prevalence of *Toxocara* infection in the dogs and cats

Animal kind	No. of examined animals	No. of infected animals	Prevalence (%)
Dogs	73	11	15
Cats	51	2	3.9

Moreover the prevalence in dogs subjected to a deworming regimen was 6%. Whereas the prevalence in cats subjected to a deworming regimen was 0%.

Factors affecting the prevalence of Toxocara infections in dogs and cats

Statistical analysis of the factors influencing *Toxocara* infection was applied through use of logistic regression (Backward stepwise [likelihood ratio]). The findings revealed that there is no significant statistical association between the gender and breed with the infection in both dogs and cats. In the housed dogs; use of anthelmintics, and age were statistically significant with *P*-value at 0.000, 0.023, respectively. Whereas in the housed cats; only use of anthelmintics was statistically significant with *P*-value at 0.000.

Moreover dogs up to six months old were significantly more infected with *T. canis* than other age groups. Duncan test permitted to assess meaningful difference ($P \leq 0.05$) between different age groups as shown in Table 4.

Table 4: *Results of multiple comparisons between different age groups of dogs*

Age group	Age groups	Significance
1 – 6 months	> 6 –18 months	0.531
	> 18 – 48 months	0.168
	> 48 months	0.004 *
> 6 – 18 months	1– 6 months	0.531
	> 18 – 48 months	0.537
	> 48 months	0.026 *
> 18 – 48 months	1– 6 months	0.168
	> 6 – 18 months	0.537
	> 48 months	0.069
> 48 months	1– 6 months	0.004 *
	> 6 – 18 months	0.026 *
	> 18 – 48 months	0.069

* The mean difference is significant at the 0.05 level.

DISCUSSION

Based on the screening of faecal samples in the current study, the overall prevalence of *Toxocara canis* infestation was 15% in the dogs, meanwhile the overall prevalence of cats shedding *Toxocara cati* eggs was 3.9%. The results confirmed the low prevalence of *Toxocara* spp in dogs and cats as compared to two previously studies conducted by Kaal, *et al.*, [23, 24] found that 43.5% and 68.8% of housed dogs and cats were positive, respectively.

Our findings showed that the frequency of *T. canis* in dogs is in line with percentage reported in Belgium, where the prevalence of *T. canis* by detecting eggs in faeces was 17.4% while on necropsy; 38.9% of dogs were found infected [25], in dogs of Cordoba, Spain with (17.7%) [26], and (16.6%) in Slovakia [27]. By investigation of the relevant literatures about the prevalence of *T. canis* infection in different countries showed vary roughly results. For example was 3.6% in Ireland [28], while in Hungary, *T. canis* eggs were found in 24.3% of the dogs [29]. Legrottaglie, *et al.*, detected *T. canis* in 11.1% in dogs of Pisa, Italy [30]. Whereas in Germany, *T. canis* was detected in 22.4% of dogs [31], then subsequently in another study carried by the same researchers 6.1% of dogs only were found infected with this parasite [32].

From the present study, it appeared that age of the dog was one of the significant factors in varying prevalence rate of *T. canis*. Higher prevalence in young dogs might be due to prenatal and transmammary transmission of *Toxocara* infection [33]. The gender nor breed did not emerge as a significant factors in this study.

Our result demonstrated in cats is in accordance with the finding of routinely done parasitological examination of cats at the Institute for Parasitology, University of Veterinary Medicine Hannover- Germany in 2010, showed only 3.9 % *T. cati* positive samples [34]. The finding of *T. cati* in the present study is in partial agreement with reported in Belgium which was 5%, [35], while in Perth, Australia was 3.2% [36], and 4.6% in the Netherlands [37]. In contrast to that, Barutzki and Schaper, (2003) reported that the overall prevalence of *T. cati* (*T. mystax*) among the housed cats in Germany was (26.2%) [31].

Huge differences can easily be detected in results concerning the prevalence of infection with *Toxocara* spp, even in surveys conducted in the same country. This is mostly attributed to differences in sampling protocols including; source and age of animals, prior anthelmintic usage in sampled animals, in addition to different demographics of the populations, as well as health care, animal management practices, and environmental conditions. It is even more difficult to compare results from different studies. The dog and cat populations that are studied vary widely, and may include household from urban or rural areas, or strays. Moreover the number of sampled dogs and cats vary from only a few dozens to several thousands. Over and above, different techniques were used for faecal examinations are vary in their sensitivity, perhaps it would be advisable to try to standardize the coprological methods used.

Infection of cats with *T. cati* can occur either through ingestion of infective eggs or from eating rodents containing larvae in their tissues or by drinking infective milk from their mothers. Since the cats habitually bury their faeces, the spread of infection through the medium of infective eggs is less likely to occur than from the predatory habits of cats [38]. Epidemiological studies carried out to date have centered on *T. canis*, considered the one of the main aetiological agents of the diseases in man. Because a lower environmental contamination from cats faeces due to their defecating habits was estimated, *T. cati* has scarcely been associated with the occurrence of cases in man [39-41]. Indeed the relative ease of identifying *Toxocara* spp ova and high probability of detecting patent infections (a female worm can produce 100.000 eggs/day), these eggs are very resistant to environmental extremes, and remain potentially infective throughout the area for years, that may be the reason why *Toxocara* spp are the most frequently detected nematode endoparasites in dogs and cats [42]. Even in the developed world in Europe, toxocariasis is still persisting in large endemic areas despite the availability of highly efficient anthelmintic for dogs and cats [43].

In public spaces where animals are allowed access, they can liberate *Toxocara* spp eggs into the environment through their faeces and thus generate a risk for the population particularly children [44, 45, 46, 47, 48]. Treatment of queens with Selamectin prior to queening as described by Evans, *et al.*, [49] markedly reduces the likelihood that the parasite will infect the kittens. This measure is important since *T. cati* is implied as causative agent of visceral larva migrans in human beings [40], and therefore, care must be taken to diminish the risk of infection to animals and human beings.

It was evident from our research study that most of owners are not aware of the zoonotic potential of the parasites carried by their pets, or their mode of transmission to humans. This lack of knowledge seems to be the main reason for the apparent negligence of the owners in deworming their pets [50].

The findings of the current study showed that the prevalence of *T. canis* in the dogs used anthelmintic was (6%), this can attribute to many suggestions. First of all to that the somatic type of migration is exemplified when the infective eggs of *T. canis* are ingested by adult dogs, second stage larvae are to be found in various tissues of the body (e.g. liver, lungs and kidneys) and at this stage they have undergone no development. Such larvae become resident in the somatic tissues of the adult dogs and the larval stages in the tissues are much less susceptible to anthelmintics and if a drug is active against larval stages, it must frequently be given in a markedly increased dose [22]. The second suggestion is the resistance to anthelmintic as major concern, which must be considered and evaluated locally [51]. Lastly, failure to routinely deworm pet dogs and cats with anthelmintic products may account for the higher than expected prevalence of parasitism with intestinal helminthes in these companion animals. Faecal examination prior to anthelmintic treatment would enable the targeted treatment of parasites, with the clinician selecting an anthelmintic which had spectrum against either nematodes or cestodes, in addition to use antiprotozoal drug in a case of protozoal infection.

Inadequately awareness has been paid on comparative clinical epidemiology of toxocariasis, and its consequence on public health, despite an increase in population of humans and pets in Tripoli city. The trend of keeping dogs and cats as pet animals is increasing day by day. In addition, there is a lack of pet registration policy and animal health attention on the part of pet owners. This may help perpetuate toxocariasis and other infectious diseases of zoonotic importance in dogs and cats.

CONCLUSION

The results are of the present study demonstrate value to estimate *Toxocara* impact and to quantitatively assist researchers, veterinarians and pet owners with suitable information to control this zoonotic parasite. The emphasis should be focused to safeguard the pets from *Toxocara* implications. Moreover, there is need for coprological, in combination with molecular and seroepidemiological studies against *Toxocara* in humans (especially those at greatest risk; children, the elderly and immunocompromised people), and also require for further research to be undertaken on helminth eggs and larvae in soil, to ascertain the public health significance and determine environmental contamination, respectively. This might provide a scientific basis for advocacy aimed at unifying human medical and veterinary medical disciplines against zoonotic diseases occurring in the public health arena in line with the "One

Health" concept; furthermore, for the formulation of better control measures in both animals and man.

DISCLOSURE STATEMENT

The authors declare that they have no personal or financial relationships that may constitute a conflict of interest.

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