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Prevalence of zoonotic important *Toxocara* eggs in soil samples of public places in and around Tirupati, Andhra Pradesh, India

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Abstract

Toxocariasis is one of the most frequently reporting public health problems. The main objective of this study was to assess the level of contamination of soil with *Toxocara* species eggs in the places of public movements like parks, play grounds, roadsides/ streets/ sidewalks. Among the 75 soil samples, only 10 samples (13.33%) were positive for the presence of *Toxocara* eggs. Out of 20 samples examined from public parks, three samples (15%) were shown positive for presence of *Toxocara* eggs. The screening of 25 samples from play grounds has revealed that 3 samples (12%) were positive for *Toxocara* eggs. Out of 30 samples screened from roadsides/ streets/ sidewalks has revealed 4 samples (13.33%) of *Toxocara* eggs. Among the clay and sandy type of soils, clay soils have shown high percentage (17.14%) of *Toxocara* eggs than the sandy type of soils (10%). The percentage of *Toxocara* eggs in public parks has revealed that children play areas are highly contaminated with eggs and may pose risk to the public. Hence there is a need for public health awareness.

Keywords: toxocara, Public parks, Playgrounds, Roadsides, soil samples

Introduction

Human-animal bond which means close relationship of people with their companion animals provides benefits with regard to socialization, mental health and even physical well being [16]. Along with these benefits, potential health hazards are also associated with the ownership of a pet [16].

Toxocariasis is one of the most frequently reporting public health problems [16]. It is a zoonotic geohelminthic disease occurring worldwide and is caused by larval stage of *Toxocara canis* or *Toxocara cati* [4] which are the common roundworms living in the intestine of almost all new borne puppies, kittens and some adults dogs and cats. Larval form is present in the tissues of all these animals including birds, mammals and humans. It is not clearly mentioned which one of these species is most relevant in epidemiology of infection due to inability of routine procedures to distinguish one species from the other [4].

Man acts as paratenic host for Toxocariasis as the larvae will not develop in him but it will migrate and survive for a long period [15]. The route of transmission to humans is by oral ingestion of *Toxocara* eggs from contaminated soil i.e. saproozoonoses, from unwashed hands or raw vegetables, by direct contact with pets. The mode of transmission may also be due to ingestion of *Toxocara* larvae in undercooked organ and muscle tissue of infected unnatural hosts such as chickens, cattle and sheep [2, 14, 19, 22, 24].

The lifestyle of the people is changing in recent times. Most of the people spend their free time by taking their pets during the week at recreational areas which cover all parks, bicycle paths, lawn, urban squares, sports complexes holiday camp areas, playgrounds, beaches and sometimes green fields also which are the main source and reservoirs of many zoonotic diseases belonging to genus *Toxocara* and *Trichuris* [5]. Several studies on soil sampling from different parts of world have revealed that parks, play grounds are contaminated particularly with *Toxocara canis* eggs [23].

Children are mostly affected with Toxocariasis than the adults because of their habit to play in yards and sandy soils which were contaminated with *Toxocara* sps. eggs. Along this, children may often keep their fingers or objects contaminated with eggs into mouth and also eat dirt sometimes [15].

Toxocara sps. eggs are unembryonated and non-infective when they excreted in faeces of infected dogs and cats. Depending on soil type and environmental conditions such as temperature and humidity, eggs will hatch into infected larval stage within a period of 3wks to several months. During this maturation period, eggs will hatch into an infective larva within the egg.

After ingestion of infective *Toxocara* species eggs by humans then eggs hatch into larva which migrate to different organs particularly liver, lungs, muscle and brain via blood and lymphatic vessels and causes human Toxocariasis. Three different syndromes of Toxocariasis were noticed namely visceral larval migrans, ocular larva migrans and covert Toxocariasis [15].

Visceral larval migrans (VLM) is observed in children between 1 to 7 yrs of age and they exhibit symptoms like persistent eosinophilia, leukocytosis, an elevated GT γ level and hyper gamma-globulinaemia [20] along with the general symptoms like malaise, fever, abdominal discomfort attributed to hepatomegaly, wheezing or coughing [9].

In ocular larval migrans (OLM), migrating *Toxocara* larvae can induce granulomatous retinal lesions which are characterized by complaints of loss of acuity, visual squint and 'seeing lights' [6]. In some cases, it may leads to complete blindness of one eye or both eyes.

Covert Toxocariasis (CT), a third clinical syndrome was found in patients with a vague complex of non-specific clinical symptoms and characterized by hepatomegaly, cough, sleep disturbances, abdominal pain, head ache and behavioral changes which are associated with raise in *Toxocara* antibodies [16].

If the larva migrates in to the brain of human then it may bring change in cognitive function of children which can be called as cerebral Toxocariasis.

The factors like sample site selection, number and volume of samples, depth of sampling, season of examination, method of egg recovery, preservation of samples and laboratory skills will influence the results of soil examination for prevalence of parasitic eggs. The relationship between soil texture and presence of *Toxocara* species eggs is not direct [23]. Though the grain size composition is similar in samples but number of eggs present may vary which is influenced by intensity of contamination, action of earthworms, wind and rainfall [7, 8].

Although, there were several surveys on Toxocariasis in India but less reports were recorded in the Tirupati region of Andhra Pradesh, India. The main objective of this study to assess the prevalence of contamination of soil with *Toxocara* species eggs in the places like parks, play grounds, roadsides/streets/ sidewalks which are present in and around the Tirupati, Andhra Pradesh.

Materials and Methods

Study Area

Study area and sample collection

A total of 75 soil samples were collected from different places in and around Tirupati. The samples were categorized as three different groups-public parks, playground and samples from roadsides/streets/sidewalks. The samples were again classified into sandy type and clay type of soil. Approximately 30 gms of each sample were collected from the surface layer of soil at a depth up to 3 cm into plastic bags. The samples collected from public parks were fenced but there was access for dogs to enter into parks through improperly fenced areas or by accompanying their owners for walking or exercise. Twenty

five samples were collected from play grounds which are situated near schools and colleges were selected. These play grounds were also fenced but the dogs were entering through the gate but the frequency of roaming of dogs is less. From roadsides/ streets/ sidewalks which have free roaming of pet dogs/street dogs as the dog owners are bringing their pets for defecation, thirty samples were collected.

Parasitic examination of soil samples

In the present study, Dunsmore modified technique was used to detect *Toxocara* eggs in soil samples. It is a centrifugal floatation technique in which Sodium Nitrate (Na_3NO_3 , $d=1.22$) used as floatation fluid. When the amount of soil to be examined increases then the possibility of observation of eggs of parasites also increases [21].

In the present study, 30 gm each of soil sample was sieved through 4mm² meshes to remove large pieces of organic matter and stones. The samples were soaked overnight with 50ml of distilled water and three drops of Tween 80 in a 100ml beaker. This mixture was homogenized using a mixer for 10 min. at 5000 rpm. The mixture is filled in two centrifuge tubes of 15ml capacity and again centrifuged at 2000 rpm for 10 min. The supernatant was discarded and Na_3NO_3 was added to half of the tube and sediment is suspended. The tubes were filled with Na_3NO_3 up to the top and a slide is placed in menisci for 25 min. These slides were observed under microscope.

Based on the morphology and morphometry, the helminths ova were identified as *Toxocara* sps. [21].

Results

A total of 75 soil samples collected from different areas in and around Tirupati were examined for detection of *Toxocara* eggs. Among them 10 soil samples were shown positive for the presence of *Toxocara* eggs (Table 1 and Fig.1).

Out of 20 samples collected from public parks, three were positive for eggs of *Toxocara* with a prevalence of 15%. Among the 25 samples collected from play grounds, three were positive for *Toxocara* eggs with a prevalence rate of 12%. Out of 30 soil samples collected from road sides/streets/sidewalks, 4 samples (13.3%) were found positive for *Toxocara* eggs.

Table 1: Prevalence of *Toxocara* eggs in different areas in and around Tirupati

Site of Collection	Number of samples	positive	%
Public parks	20	3	15
Play grounds	25	3	12
Road sides/ street/side walks	30	4	13.33
Total	75	10	13.33

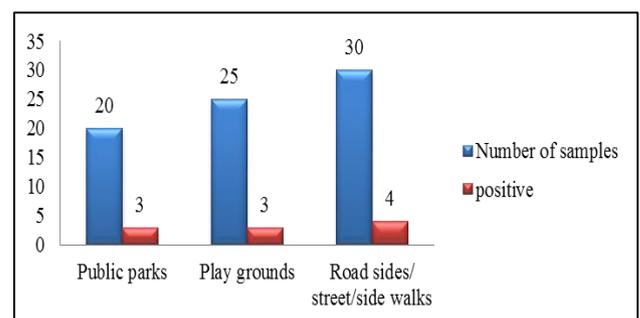
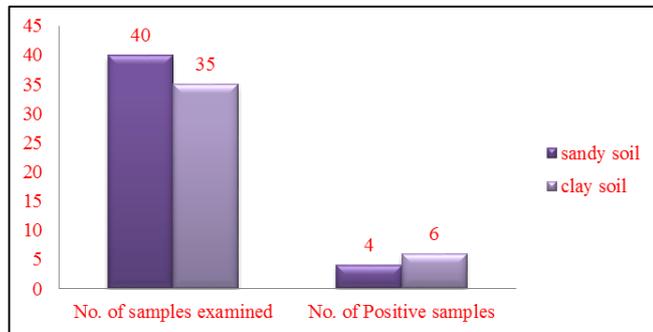


Fig 1

Among the clay and sandy type of soils, clay soils were shown high prevalence rate (17.14%) for *Toxocara* eggs than sandy type of samples (10%) (Table 2 and Fig.2).

Table 2: *Toxocara* eggs in different types of soils

Type of soil	No. of samples examined	No. of Positive samples	%
sandy soil	40	4	10
clay soil	35	6	17.14
Total	75	10	13.33



Discussion

The present study has revealed 13.3% prevalence of *Toxocara* eggs in soil samples collected from different parts of Tirupati, Andhra Pradesh which is almost similar to findings of Sudhakar *et al.* (2013) [23] and Tun *et al.* (2015) [26] who reported 12.84% and 11.9% prevalence of *Toxocara* eggs from soil samples. A litter higher prevalence than the present investigation was reported by Bojar and Kłapeć (2012) [5] (16.6%), Harbinder *et al.* (1997) [10] (19.7%) and Aydenizoz (2006) (15.6%) [1]. In contrary to the present study findings, Bojanich *et al.* (2015) [4] reported zero prevalence of *Toxocara* eggs from their samples while Paller and Emmanuel (2014) [17] reported highest prevalence (77%) of *Toxocara* eggs in Philippines.

Among the three different sites of collection of soil samples, samples from public parks have shown higher prevalence (15%) of *Toxocara* eggs which is slight lower to investigations of Sudhakar *et al.* (2013) [23] who reported 17.02% prevalence rate. The studies of Berenji *et al.* (2015) [3] reported 9.2% and 11.3% prevalence of *Toxocara* species eggs from Mashad and Khaf cities, North east of Iran and Khazan *et al.* (2012) [11] also reported low prevalence (10%) from Tehran city of Iran than the present investigation. In contrary to current findings, Mohsen *et al.* (2015) [13] (28.6%) and Zibaei *et al.* (2010) [27] (22.2%) reported high prevalence of *Toxocara* eggs.

The next higher prevalence (13.3%) of *Toxocara* eggs was observed in roadsides/ streets/ sidewalks samples which is almost similar to findings of Sudhakar *et al.* (2013) [23] who reported 11.71% prevalence but a little more incidence rate (17.17%) was reported by Poliana Tudor (2015) [18].

In the present study, samples from play grounds have revealed 12% prevalence of *Toxocara* eggs which is higher than the findings of Sudhakar *et al.* (2013) [23] who reported 8.33% prevalence of *Toxocara* eggs.

In general, public parks and play grounds will have free access to pet and stray animals. Urbanization is increasing dog's ownership trend which may create a problem of contamination of human environment with infectious stages of zoonoses originating from dogs and cats [23] by bringing their pets to parks and roadsides everyday for defecation

which is contaminating soil. Sometimes, stray and scavenging animals will attracted to food left by street food vendors which will results in contamination of soil by dog's defecation. The present study also revealed that samples from play ground have shown lesser prevalence of *Toxocara* eggs than the other two sites of collection. This may because of sandy soil present in play grounds which doesn't retain water and also due to low humidity which is lethal to *Toxocara* eggs.

The present study highlights the level of contamination of soil with *Toxocara* eggs and recommends to follow strict preventive measures like regular deworming of dogs and cats especially puppies and kittens, regular deworming of children, advising children to wash their hands after playing in the sand, regular clipping of nails of children, reducing the number of uncontrolled and stray pets, municipality authorities also should take care to prevent contamination of recreational areas by undertaking different schemes and projects and promoting responsible pet ownership.

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