

Spatial Distribution of Ancylostomiasis in Soil of Slums of Northren Lahore

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Abstract: A study was launched in slums of Lahore, Punjab from Nov 2006 to Oct 2008. Thematic disease map showed 3.22 % prevalence of *Ancylostoma caninum* (*A.caninum*) in contaminated soil samples collected from slums of Lahore. Area wise the highest prevalence of *A. caninum*'s eggs shed by dogs in contaminated soil samples of slums was observed 5 % in Missri Shah followed by 4.67 % in Bhutto Colony 3.83 % in Siddiqia Colony, 2.83 % in Khairdin Park, 2 % in Sheikhpura Road and lowest 1 % in Scheme No 2 respectively. The highest month wise prevalence 10.67 % was observed in October that gradually declined 0.67% in March. The overall prevalence ratio of ancylostomiasis was (3.22 %). Thematic Disease map showed spatial prevalence.

Keyword: Slums, Pakistan, Prevalence, ancylostomiasis, *Ancylostoma caninum*.

Objective

To observe the spatial distribution of *A.caninum* and to assess the degree of prevalence (%) in soil being contaminated by faeces of pet / stray dogs in slums of Lahore.

I. Introduction And Literature Review

Ancylostomiasis is a widely spread parasitic disease in dogs / cats, in tropical and subtropical areas (Loukas et al. 2006) cause by *Ancylostoma caninum* (*A.caninum*) (Umar, 2009). It is the most common parasite of dog (Bojar and Klapac, 2012) with cosmopolitan distribution (Sowemimo and Asaolu, 2008), exists as zoonotic agent (Edosomwan and Chinweuba, 2012) that constitute a significant risk for public health (Kollataj et al., 2012). Ancylostomiasis is also a soil transmitted disease usually known as sapro zoonosis i.e. infected eggs spread in soil, on vegetables, raw fruits and herbs (Jaffry et al. 2009). *A. caninum* is very pathogenic to stray dog (Ashraf et al., 2008) than domestic (Umar, 2009) because it's infective filarial larvae from soil can penetrate into skin of dog cause lesion, wet eczema that is very severe to dog.

II. Importance Of *A. caninum* In Dog

A.caninum causes hemorrhagic diarrhoea (Lamb et al. 2012), atrophy of intestinal villi, eczema especially in rainy season when they get their feet be wet (Ashraf et al. 2008) anemia (Loukas and Prociw, 2001) and eosinophila 10 % to 15 % less than man (Bhatti et al. 2009; Ngui et al. 2012).

III. Life Cycle In Dog

A. caninum lives in small intestine of dog (Ashraf et al. 2008), female lays 16,000 eggs / day, eliminate via faeces in environment, contaminate the soil, vegetables, fruits, and herbs (Khayatnouri and Garedaghi, 2012). Eggs can survive at temperature between 25⁰ C to 30⁰C, humidity above 90 %, under shade, availability of O₂ and change into 1st stage larva, after one week molts into 3rd stage larva. This is infective not only to definite host (pups) itself but also for human, live in soil for further 3 week. It can now enter to pups via oral route as they ingest contaminated soil or via penetration of skin, cause skin lesions and through blood stream lodge into small intestine as 4th stage larva and after maturity again the cycle is repeated. It causes eosinophilic enteritis in dogs restricted to small intestine, treatable but recurrent with seasonal changing pattern. 20 days after post infection low level of Hb was observed in dogs due to low iron diet (Held et al. 2006). The juvenile larvae transfer to pups via transmammary / transplacental transmission (Edosomwan and Chinweuba, 2012).

After examining faecal samples of dogs the prevalence rate 13.4 % for *A. caninum* and 2.5 % for *T. canis* was observed (Isabel et al. 2005), whereas in Mashad out of 100 stray dogs 91 % were found naturally infected, having 1 % infection of *A. caninum* and 37 % *T. canis* (Razmi et al. 2006). Out of 203 faecal samples of dogs 59.1 % were positive for *A. caninum*, stray dogs showed prevalence rate 72.7 % and pet 54 % due to the fact that pet were living in proper situations and were provided balance food as compared to stray dogs (Ashraf,

et al. 2008). In Argentina in 2004 393 dog's faecal samples were observed for the presence of *T. canis*, 114 (29.0%) samples were infested with *A. caninum* eggs, out of them and 53 % eggs were found in urban slums areas with low SES (Martin and Demonte, 2008). Freshly collected and examined faecal material of dogs showed high prevalence as compared to the frozen one (Cringoli *et al.* 2011). In the case of the nematodes, *A. caninum* had a high prevalence (35.71%) (Ugwoke *et al.* 2011). In Malaysia 221 faecal samples of dogs were examined, 48 % were found positive for *A. caninum* infestation, 71.4 % rural stray dogs and 48 % in urban were naturally infected (Mahdy *et al.* 2012).

Soil samples were the tools to determine the prevalence / infection ratio in respect to the inhabitants from where these samples were taken and also depicted the type of infestation of infected and carrier man / dog or other pets. Soil contamination was being increased due to popular fashion to keep dog as a pet (Avcioglu and Balkaya, 2011). Ova of helminth deposited in soil, hibernated and the infective form harmed the person came in direct contact with that contaminated soil, eggs might be transferred from soil to vegetables, fruits, insects, animals and man. Level of soil contamination had been determined by level of contamination of parks, public playgrounds and soil of the surroundings being contaminated by stray or pet dogs (Kurnosov, 2009) that in turn depicted the type and degree of prevalence / infection being prevailed in the inhabitant and stray or pet dogs. In Wrolawski, Poland out of 185 soil samples 20 % were positive, out of them 3.2 % prevalence was for *T. canis* and *A. caninum* (4.9 %) respectively (Perec-Matysiak *et al.* 2008). Whereas in Nigeria, 608 soil samples were examined and overall prevalence was 62 %, out of it 7.2 % were positive for *A. lumbricoides*, 3.7 % for *T. trichiura*, 50.4 % *T. canis*, 9.0 % *A. caninum* and 3.9 % for *E. granulosus* (Maikai *et al.* 2008). In Poland 215 soil samples were collected from beech areas and playgrounds, 18.6% samples were found positive for *A. caninum* eggs (Bojar and Kłapeć, 2012).

IV. Material And Methods

4.1. Collection Of Specimens From The Soil

To record the prevalence of ova of zoonotic parasites and soil transmitted helminthes (STHs), 3600 soil samples (25 / locality / month) were collected from 6 different localities i.e. 6 slums (Bhutto Colony, Siddiqia Colony, Scheme No 2, Sheikhpura Road, Khairdin Park and Missrisha) of Lahore, Punjab, Pakistan from November 2006 to October 2008. Soil was collected from five different depths of the same spot i.e. from the playgrounds, public parks, fields, filth deposes and near the dunghills. Samples were immediately transferred to the Parasitology Laboratory, University of the Punjab, Lahore, Pakistan. Soil was kept in screw capped plastic vials clearly labeled with date and place of collection. For the presence of helminth's eggs these samples were examined on the same day by Sodium hypochlorite recovery technique (WHO, 1991 and Urquhart *et al.* 2001) and by Damp pad technique to identify ova (Seppo *et al.* 2002).

V. Sodium Hypochlorite Technique

In a test tube 2 g. of sieved soil sample was placed with 5 ml of 30% sodium hypochlorite (NaOCl) solution (Soulsby, 1982). The tube was shaken intermittently. A few drops of prepared solution was placed on glass slide, placed cover glass and examined microscopically at 40× magnification, to identify the helminth's ovas on the basis of morphology described by (WHO, 1991 and Urquhart *et al.* 2001).

VI. Damp Pad Technique

About 5 g of soil was placed in a test tube containing formal water, homogenized for one minute. The suspension was strained through wet cheese cloth placed over funnel to remove the coarse sand particles. Ether was added to the filtrate in a centrifuge tube and the mixture was centrifuged at 2,300 rpm for 3 minutes. The supernatant was decanted and the sediment placed on a clean slide, covered with a cover slip and examined microscopically (Nock *et al.* 2003). The ova / larvae of helminth parasites were identified with reference to Atlas of Parasitology (Seppo *et al.* 2002).

VII. Application Of Geographical Information System (GIS):

The Geographical Information System (GIS) a digital data base management system (Guiqin *et al.*, 2009) was applied to facilitate quick understanding, elaborated the research work, showed links between transmission and spatial distribution (Gorsevski *et al.* 2012). Window 2007, Arc GIS 9.2 and Arc view were used. Spatial data about slums of northern Lahore marked for research work was collected physically from the Solid Waste Management (SWM) and Geographical Information Department of Punjab Government (GIS).

VIII. Application Of Thematic Disease Maps

Spatial information, diagrammatical representation, geographical distribution and position of slums of northern Lahore and spatial distribution of observed *Ancylostoma caninum*'s eggs in soil samples was organized

by tabulating all data in Excel 2007 and then transferred to Arc GIS 9.2 and Arc view using various software of GIS to draw thematic disease maps to show several layers in a sequence.

IX. Results

9.1 *Ancylostoma Caninum's* Eggs Shed By Dog In Soil Samples

3600 soil samples were observed from the 6 slums (Bhutto Colony, Siddiqia Colony, Scheme No 2, Sheikhpura Road, Khairdin Park and Missri Shah) of Lahore, Punjab, Pakistan, from November 2006 to October 2008. A total of 3600 soil samples /area / 2 years were examined, showed 2.79 % overall prevalence of *A. caninum* infestation (Table 1).

Overall Prevalence

An overall area wise prevalence (%) of *A. caninum's* eggs in the soil showed prevalence (3.22%) ($P < 0.001$) in slums of Lahore, Punjab from November 2006 to October 2008 (Table 1).

Area Wise Prevalence (%)

Area wise high prevalence of *A. caninum's* eggs in soil of six slums of Lahore, Punjab province was observed in Missri Shah (5%) followed by Bhutto Colony (4.67%), Siddiqia Colony (3.83 %), Khairdin Park (2.83 %), Sheikhpura Road (2 %) whereas lowest in Scheme No 2 (1%) (Table 1; Fig. 1). Thematic disease Map 1 showed spatial distribution of eggs of *A. caninum* in contaminated soil samples of slums.

Month Wise Prevalence (%)

After analyzing month wise data, highest prevalence (10.67%) of was observed in October that gradually decreased to (1 %) in November followed by a decline to the lowest (0.67 %) in March of slums (Table 1; Fig 1). When statistical analysis (Z-test) was applied on month wise data, the prevalence (%) of March was the lowest, so the month of March was compared with other months. No significant difference between prevalence (%) of the month December, April, June, July and August was observed. Whereas November ($P < 0.001$), September ($P < 0.001$) and October ($P < 0.01$) showed significant difference with respect to March (Table 1).

X. Discussion

In the present study soil samples analysis showed 3.22 % overall prevalence. The outcomes of the present study are consistent with findings obtained from Wrocław collected from the parks, playgrounds, backyards and sandpits (Perec-Matysiak *et al.* 2008). Overall prevalence 20 % was observed in Poland, these findings are contrary to the observation of the present study due to variation in used technique, locality, climatic conditions. Similarly in Nigeria 9% prevalence of *Ancylostoma* spp including *A. caninum* was observed (Maikai *et al.* 2008) and 18.6% in Poland (Bojar and Klapac, 2012) contrary to the findings of the present study due to the difference in prevailing environmental conditions, SES and technique used. It was observed that soil contamination is increasing day by day due to increase population of stray dogs and immigrants from the country sides, residing in Kachiabadies "temporary shelters" with very low SES, inadequate sewage and sanitary system. Therefore it is the urgent need to eliminate the risk of infection in future by deworming the pet / stray dogs and national based control programme should be launched with provision of awareness, health education and proper living facilities. Thematic disease map has supported the findings of the present studied areas, also matched with the observations depicted by photographs. It is therefore necessary to improve the sewage, water system and give awareness to the inhabitants to improve their health and avoid throwing waste in open.

XI. Conclusion

GIS was used to depict the spatial distribution. Ancylostomiasis is going to increase in human population due to increase in soil contamination as pet owners motivate their pet to defecate in parks/ surrounding areas of their residents and unaware about the biology of parasites. By improving the thematic disease map government could hit the infected pets or eliminate stray dogs to reduce the level of transmission of infection.

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TABLE 1: Overall areawise, monthwise and seasonwise prevalence (%) of *Ancylostoma caninum*'s eggs shed by dogs in soil samples of slums of Lahore, Punjab, Pakistan from November 2006- October 2008.

Fact ors	Total n=3600			Prevalence (%±S.E)
	Slums	Obser-ved	Infect-ed	
Areas	Bhutto Colony	n=600/year / area	28	4.67±0.86***
	Siddiquia Colony		23	3.83±0.78**
	Scheme No. 2		6	1.00±0.41
	Sheikhupura Road		12	2.00±0.57
	Khairdin Park		17	2.83±0.68
	Missri Shah		30	5.00±0.89**
Total		3600	116	3.22±0.29
Time (months)	Nov2006&2007	n= 300 / month / year	3	1.00±0.57
	Dec 2006&2007		5	1.67±0.74
	Jan 2007&2008		7	2.33±0.87
	Feb 2007&2008		7	2.33±0.87
	Mar 2007&2008		2	0.67±0.47*
	Apr 2007&2008		3	1.00±0.57
	May 2007&008		11	3.67±1.09
	Jun 2007&2008		9	3.00±0.98
	Jul 2007&2008		8	2.67±0.93
	Aug 2007&008		11	3.67±1.09
	Sep 2007&2008		18	6.00±1.37
	Oct 2007&2008		32	10.67±1.78***
Total		3600	116	3.22±0.29
Season	Winter	1200	22	1.83±0.39
	Spring	600	5	0.83±0.37***
	Summer	1200	39	3.25±0.51***
	Autumnn	600	50	8.33±1.13
Overall prevalence (%) (Slums+Urban)				

*P<.05, **P<.01, ***P<.001 Z-test

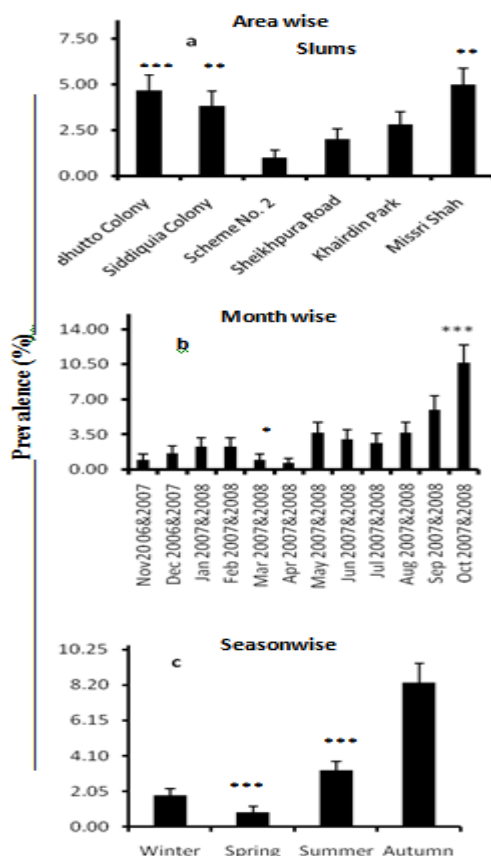


Fig. 1: Prevalence (%) of *Ancylostoma caninum*'s eggs shed by dogs in soil samples of slums (a) area wise (b) month wise and (c) season wise of Lahore from Nov 2006- Oct 2008. Z-test *=P<0.05, **=P<0.01, ***P<.001.

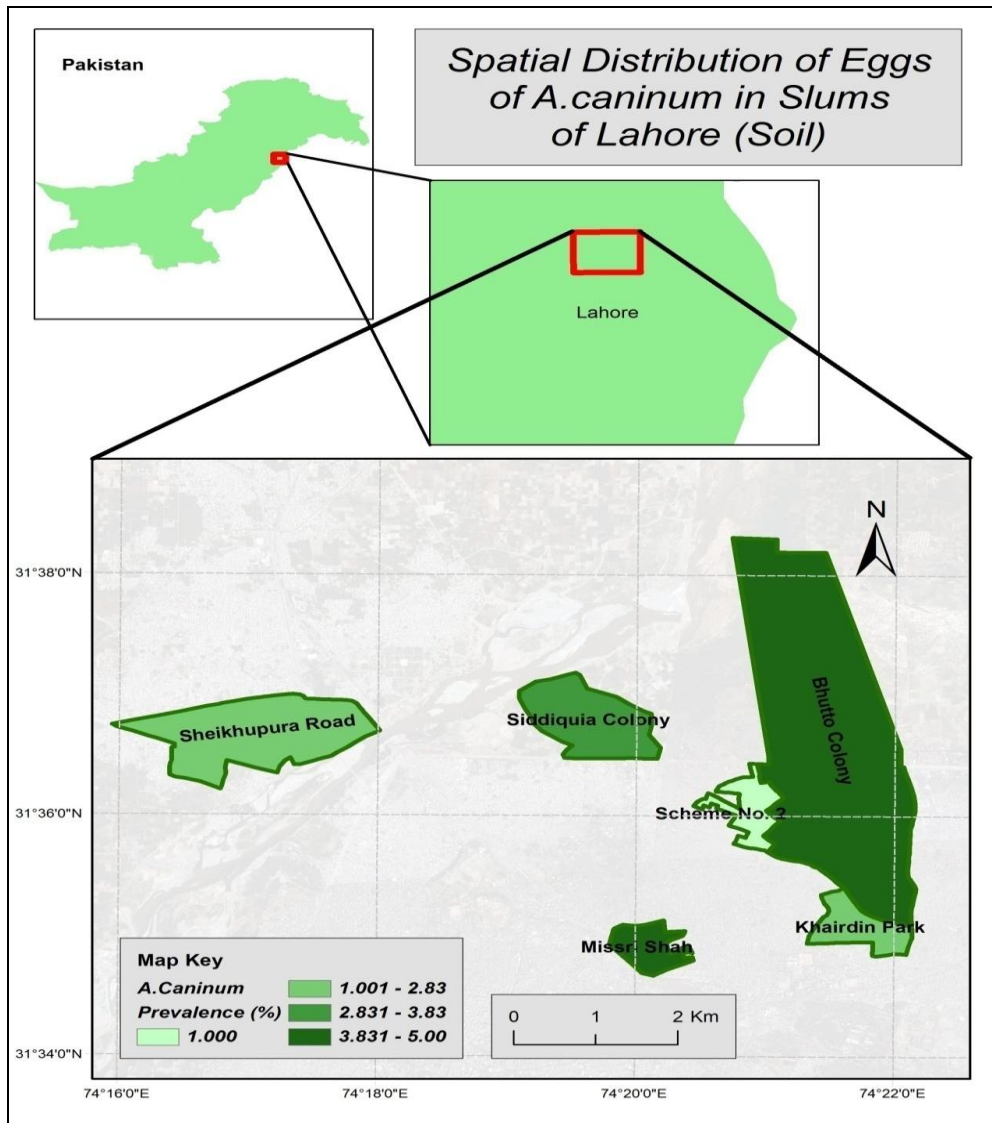


Fig. 2: Thematic disease map 1: Spatial distribution of eggs of *Ancylostoma caninum* (soil) in slums of Northern-Lahore from Nov.2008 to Oct.2009