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Studies on the prevalence of parasitic infections in soil in and around Hyderabad, Telangana State, India

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Abstract
Out of 230 soil samples collected and screened from different locations in and around Hyderabad region, 88 (38.26%) were found positive for soil borne parasites by O'Lorcain (1994) method. Highest prevalence was recorded in play grounds 49.05% (26/53) followed by residential areas, veterinary dispensaries and public parks with 39.43% (28/71), 36.73% (18/49) and 28.07% (16/57), respectively. A total of 9 parasitic species including five nematodes, one cestode and three protozoans were isolated in which highest prevalence was recorded with *Toxocara* spp. as 13.04% (30/230) followed by *Ancylostoma* spp., *Strongyloides* spp., *Trichuris* spp., *Ascaris* spp., *Eimeria* spp., *Entamoeba* spp., *Taeniidae* and *Balantidium* spp. with prevalence of 6.52% (15/230), 4.78% (11/230), 4.34 (10/230), 3.91% (9/230), 2.60% (6/230), 1.30% (3/230), 0.86% (2/230) and 0.86 (2/230), respectively. Prevalence of soil borne parasites indicated a significantly ($P \leq 0.01$) highest prevalence in Rainy season 47.19% (42/89) than in summer 36.98% (27/73) and winter 27.96% (19/68) seasons. There was no significant difference between winter and summer season.

Keywords: Soil borne parasites, O'Lorcain (1994), nematodes, cestodes, protozoans

Introduction
The soil transmitted helminths are referred as geohelminths which fall under sapro-zoonotic category and can infect humans or animals from soil or any inanimate development sites (Parija,1990). The soil borne parasitic infections also impair physical and mental growth in children, thwart educational advancement and hinder the economic development (Hotez *et al*., 2006) [10]. The presence of parasitic forms in the soil is potential source of infection to humans and animals. The combination of environmental factors like temperature, adequate shade, moisture levels, relative humidity, soil pH and exposure to sunlight influence the development of parasitic stages in the soil (Brooker *et al*., 2006) [2]. Over the past few decades several techniques have been used to recover the Ascarid eggs from the soil samples *viz*., Dada (1979) [5], Quinn *et al*., (1980) [18], Kazacos (1983) [11], Dunsmore *et al*., (1984) [7], Lorcain (1994) [16] and Santarem *et al*., (2008) [19]. Charitha *et al*., (2013) [3] compared the efficacy of the three conventional floatation techniques Kazakos (1983), Lorcain (1994) [16], and Santarem *et al*., (2008) [19]. Among them Lorcain method given better results comparatively higher in recovery of parasitic stages from the soil. Forecasting the soil contamination with infective zoonotic parasites displays the local population's risk especially children are of higher risk, so the present study is to record the Prevalence of soil borne parasites of zoonotic importance in Hyderabad region of Telangana.

Materials and Methods
Collection of soil samples: Soil samples were collected over a period of a year from April 2020 to march 2021. About 200g of soil was removed from the surface to a depth 3-5 cm using shovel and placed in sealed plastic bags. Collected soil samples placed in sealed polythene covers were brought to the laboratory within few hours and which could not be processed immediately were stored at 4°C suggested by Hayward *et al*. (2006) [9], Santarem *et al*. (2008) [19] and Charitha *et al*. (2013) [3] to avoid drying of the samples.

Processing of the soil samples by Lorcain (1994) [16] method: Each representative soil sample (200g) collected was divided into an aliquot of 20g of soil sample was sieved through a mesh of 4 mm^2 pore size to remove coarse particles. Sieved soil sample was transferred into 50ml conical centrifuge tube and 25-30ml of one percent Tween80 solution was added to it and vortexed at high speed for 2 min for homogenization.

After uniform homogenization, the sample was passed through a second 1mm^2 nylon sieve. The filtrate obtained after sieving was rinsed out of the flask into a 50ml centrifuge tube and was subjected to centrifugation at 1500 rpm (327xg) for about 5 min. The supernatant was discarded and the sediment was washed twice with distilled water and centrifuged as before 1500 rpm (327xg) for about 5min. The soil sample left at the bottom was resuspended in the saturated $NaNO_3$ solution (specific gravity-1.35) and subjected for centrifugation at 4000 rpm (2325xg) for 15 min.

Sedimentation of parasitic stages: The top most 1-2 ml of floating fluid obtain after the final step was taken to 15ml centrifuge tube. Neutral distilled water of 13-14ml added to this floating fluid and mixed thoroughly so as to reduce the specific gravity and subjected to centrifugation at 4000rpm (2147xg) for 5 min. The supernatant was siphoned off carefully. Each drop of sediment fluid was subjected to microscopic examination and were enumerated based on their morphology.

Statistical analysis: The differences were analysed by the Chi-square test (Snedecor and Cochran, 1994) [21]. Statistical significance was defined as $p < 0.05$ or $p < 0.01$.

Results and Discussion

The overall prevalence of soil borne parasites, among 230 soil samples screened from different parts in Hyderabad region of Telangana was recorded as 38.26%. The highest prevalence was recorded from Playgrounds (49.05%) followed by Residential areas (39.43%), veterinary dispensaries (36.73%) and lowest in public parks (28.07%). The present findings on prevalence of soil borne parasites are more or less in agreement with the results of Charitha *et al*. (2013) [3], Kumar *et al*. (2000) [12], Anand *et al*. (2004) [1] and Shrestha *et al*. (2007) [20] who reported a prevalence of 29.19 percent in Rayalaseema region of Andhra Pradesh, 36.5 percent in Nepal, 30.7 percent in Assam and 28.5 percent in Kathmandu, respectively. However, higher prevalence of soil borne parasites than the present findings were reported in Philippines (41.33%), Brazil (75.5%), Turkey (59.5%) and Spain (40.3%) by Paller *et al*. (2019) [17], Moura *et al*. (2010) [15] and Dado *et al*. (2012), respectively. When compared to the results in the present study, lower prevalence of 17, 8.41 and 10.7% was noticed by Mizgajska (1997), Matsuo and Nakashio (2005) [13] and Motazedian *et al*. (2006) [14] in Poland, Japan and Iran, respectively. The variations in the prevalence might be due to several factors influencing the existence of populations, poor parasitic forms in the soil like hygienic practices, stray dog population within the city and suitable climatic factors prevailing in those areas.

The present findings recovered 9 parasitic species are recorded were in accordance with the soil samples from Rayalaseema region of Andhra Pradesh, Charitha *et al*. (2013) [3] reported 13 parasitic species including seven nematodes (*Ancylostoma* spp., *Ascaris* spp., *Capillaria* spp., *Oxyurida*, *Toxocara* spp., *Trichuris* spp., *Strongyloides* spp.) two cestodes (*Hymenolepis* spp. and *Taeniidae*) and four protozoans (*Balantidium* spp., *Entamoeba* spp., *Eimeria* spp. and *Isospora* spp.) were isolated. Moura *et al*. (2010) [15] screened soil samples from two indigenous territories of Brazil, reported 14 species of enteroparasites of humans and animals including seven nematodes, two cestodes and five protozoa. Stojcevic *et al*. (2010) [22] isolated 6 genera of zoonotic parasites including *Toxocara* spp., *Ancylostoma* spp., *Ascaris* spp., *Trichuris* spp., *Strongyloides* spp. and *Giardia* spp. from soil samples of Croatia. However, depending on climatic conditions, local ecological factors, stray dog populations and geographic differences, the level of soil contamination varies in different countries and even within countries.

Fig 1: Toxocara spp

Fig 2: Ascaris spp

Fig 3: Ancylostomum egg

Fig 4: Strongyloides spp

Fig 5: Trichuris egg

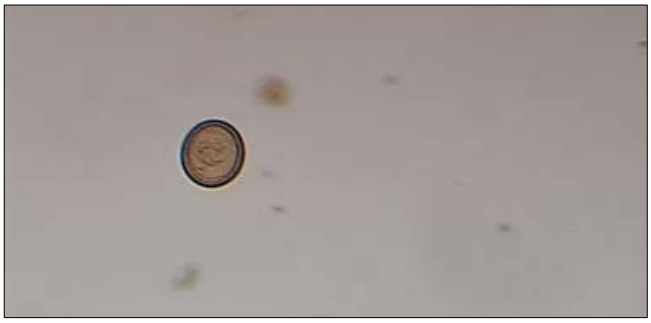

Fig 6: Taenia egg

Fig 7: Entaemoba spp

Fig 8: *Balantidium* spp

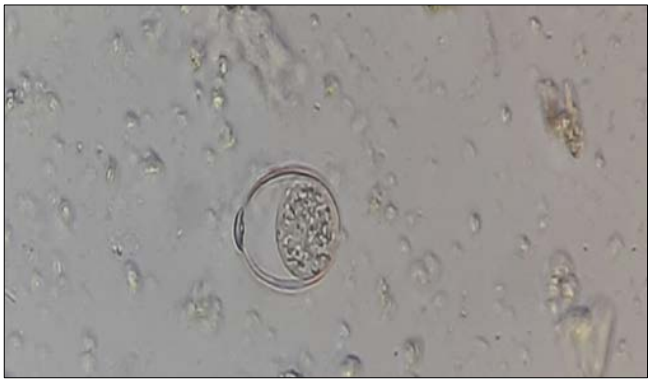

Fig 9: Eimeria spp

Fig 1 -9 Parasitic eggs/ oocysts of different species recovered from soil

Prevalence of soil borne parasites was recorded in the rainy season was 46.06% followed by winter and summer as 35.71 and 27.69 percent, respectively out of 230 soil samples examined. The present findings are in agreement with Habluetzel *et al.* (2003) [8] who reported higher soil contamination with soil borne parasites in cold months (58.8%) than in hot months (42.3%) in Marche region of Italy. Similar findings were also indicated by Shrestha *et al.* (2007) [20] who reported seasonal variations in contamination of soil with soil transmitted helminths in Nepal and Charitha *et al.* (2013) [3] who reported higher soil contamination with soil borne parasites in rainy season (37.5%) lower in summer season (22.56%) and in winter season (21.25%) and Kumar *et al.* (2000) [12] reported that soil contamination rate was higher (48.3%) during wet season compared with that observed in dry season (33.3%) in Khatmandu valley.

Table 1: species wise prevalence of soil borne parasites in and around Hyderabad, Telangana state

Sl. No.	Parasitic stages	Total positive n=230		Locations							
				Public parks n=57		Residential areas n=71		Play grounds n=53		Veterinary Dispensaries n= 49	
		P	%	P	%	P	%	P	%	P	%
Nematode eggs/larvae											
1	*Ancylostoma* spp.	15	6.52	2	3.50	3	4.22	7	13.20	3	6.12
2	*Ascaris* spp.	9	3.91	6[a]	10.52	1	1.40	-	-	2	4.08
3	*Toxocara* spp.	30	13.04	4	7.01	10	14.08	11	20.75	5	10.20
4	*Trichuris* spp.	10	4.34	1	1.75	5	7.04	2	3.77	2	4.08
5	*Strongyloides* spp.	11	4.78	2	3.50	4	5.63	3	5.66	2	4.08
Cestode eggs											
6	*Taeniidae*	2	0.86	-	-	1	1.40	1	1.88	-	-
Protozoa cysts/oocysts											
7	*Balantidium* spp.	2	0.86	-	-	1	1.40	1	1.88	-	-
8	*Entamoeba* spp.	3	1.30	-	-	1	1.40	1	1.88	1	2.04
9	*Eimeria* spp.	6	2.60	1	1.75	2	2.81	-	-	3[b]	6.12

p = number of samples found positive;% = percent prevalence. The values superscribed with different alphabetics were significantly different between four locations ($P \leq 0.05$)

Table 2: Season wise prevalence of soil borne parasites in and around Hyderabad, Telangana state

Sl. No	Season	Number of soil samples screened	Number found positive	
1	Winter (Nov-Feb)	68	19[b]	27.94
2	Rainy season (Jul-Oct)	89	42[a]	47.19
3	Summer (Mar-June)	73	27[a]	36.98

The values with different superscripts differed at $P \leq 0.01$

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