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"Effect of Climatic Factors on The Prevalence of Intestinal Helminths from Aurangabad District (M.S), India"

S. B. Avhad, V. K. Wahule, C. J. Hiware

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (M.S), India.

Email: sunil_zoology@rediffmail.com, drhiware@rediffmail.com

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Abstract: Prevalence of soil transmitted helminth infections in apparently healthy school children of mean age 9-11 years drawn randomly from one school in each tehsil of Zilla Parishad (Z.P) schools of Aurangabad district, Maharashtra, India during March 2011 to August 2012 were evaluated. The climatic factors are responsible for soil-transmitted helminths which are temperature, rainfall, and relative humidity. *Ascarisais, Trichuriasis* and *Ancylostomiasis* (Hookworm infestation) are found to be endemic in this region.The incidence of *Ascaris lumbricoides* was highest in the month of August (25.69 percent).The month of July it was (22.58 percent) followed by that of September and October with (16.58 and 14.28 percent). Also the incidence of *Trichuris trichura* was highest in July with 24.98 percent and lowest in the month of November 04.52 percent. Hookworm registered the highest incidence in the month of June 48.95 and lowest in the month of August 15.68 percent during the study period.

Introduction:

Intestinal parasitic infections are endemic worldwide and have been described as constituting the greatestsingle worldwide cause of illness and disease. Poverty, illiteracy, poor hygiene, lack of access to potable water and hot andhumid tropical climate are the factors associated with intestinal parasitic infections. The study aimed to estimate prevalenceand identify factors associated with intestinal parasitic infections among 1 to 5 years old children residing in an urban slumof Karachi Pakistan [1]. Intestinal parasitic infestations are endemic worldwide and a major public health problem in developing countries [2]. Many studies have been carried out in Pakistan [3], India [4] and elsewhere in the world regarding intestinal helminthiasis.

Intestinal helminths are multicellular pathogens that infect vast number of human and animal hosts, causing widespread chronic disease and morbidity. Poor people in developing countries endure the burden of disease caused by four common species of soil transmitted nematodes that inhabit the gastro-intestinal tract namely *Ascaris lumbricoides*, *Trichuris trichiura, Ancylostoma duodenale* and *Necator americanus* [5]. Children and pregnant women are the main sufferers from these parasitic infections [6]. The parasites are more common in rural areas in the developing countries of Asia, Africa and Central America and are often linked to poverty and other social problems such as poor sanitation and lack of clean water [7].

Soil transmitted helminths (STH) infections are among the most prevalent of chronichuman infections with an estimated 2 billion individuals infected worldwide [8]. These infections aremore prevalent in tropical and subtropical regions of thedeveloping world where adequate water supply and sanitationare lacking. The major public health significanceand economic impact of this group of pathogens is hardto quantify, although the WHO has estimated that morethan 1000 million people world-wide are infected with oneor more of the major pathogenic species of human: *Ascaris lumbricoides, Trichuris trichiura*, Hookwormand that 39 million disabilityadjusted life years are attributed to these four Nematodes [9, 10 and 11].

Materials and Methods:

Aurangabad district is situated at longitude 19.53° and latitude 75.16°. The climatic factors are responsible for soil-transmitted helminths which are temperature, rainfall and relative humidity. The maximum and minimum temperature in summer (44°C to 35°C), winter (25°C to 12°C) and Rainy (30°C to 20°C). It comes under dry and economically backward region of Maharashtra state having 750 to 1000 mm average of rainfall, temperature range having 24°C – 44°C and humidity 65 to 80%.

The survey was conducted during June 2011 to April 2012. The stool samples were collected from 547 male and female school children in the age group 9-10 years from different 7 Talukas of Aurangabad district Maharashtra, India.

Prevalence and Intensity: Five hundred and forty seven school children, age 9-10 years, in 8 randomly selected primary schools in Aurangabad district, Maharashtra state, were investigated for their intestinal helminthic infections between June 2011 to April 2012.
The schools included are as follows:

Sr. no	School	Code
1.	Bhartiya Primay School, Hudco, N-11 Aurangabad	S1
2.	Amar Primary School, Sanjay Nagar, Aurangabad	S2
3.	Zilla Parishad School, (Z.P.), Waluj, Tal –Gangapur	S3
4.	Zilla Parishad School, (Z.P.), Dongergaon, Tal – Phulambri.	S4
5.	Ramkrishna School, Tal- Sillod	S5
6.	Zilla Parishad School, (Z.P.), Tal. Paithan	S6
7.	Central school, Yellora, Tal- Khultabad	S7
8.	Zilla Parishad School, (Z.P.), Tal – Vaijapur.	S8

Collection and examination of faecal samples:

The pupils were educated on the causes of intestinal helminthic infections among school aged children and they were convinced that every child ought to be free from such infections, thus the necessity of participating in the research work was appreciated by them. Thereafter, wide mouth corked sterile bottles were given to the pupils for the collection of their stool samples at home.

The stool samples were properly labeled and were carried in a cold box filled with ice packs and transported to the private laboratory for analysis. The samples that could not be analysed immediately were preserved using 10% formalin until they were examined [12]. Stool analysis was performed using the Kato-Katz technique [6].

The following formula is used to calculate the prevalence and intensity of infection in a community according to WHO guidelines.

$$\text{Prevalence} = \frac{\text{Number of subjects testing positive}}{\text{Number of subjects investigated}} \times 100$$

Stool examination:

Fresh morning stool samples were collected in nylon containers containing 10 ml of 10% formaldehyde. The containers were labeled, and immediately transported to the pathology laboratory for further processing. The stool specimens were processed using Water low's classification.

Results:

The temperature may rise to 44°C and

above in summer. The average rainfall is 30 inches (75 cms). Most of the precipitation is in the rainy season only. The cases studied here were drawn from; the district of Aurangabad (population 2.5 million. *Ascarisais, Trichuriasis* and *Ancylostomiasis* (Hookworm infestation) are found to be endemic in this region.

The month-wise incidence of *Ascaris, Trichuris* and Hookworm during June 2011 to April 2012 was correlated with climatic factors like air temperature, rainfall and relative humidity.

During the study period the incidence of *Ascaris lumbricoides* was highest in the month of August (25.69 percent). In the month of July it was (22.58 percent) followed by that of September and October with (16.58 and 14.28 percent). A gradual fall in the incidence of *Ascariasis* was also found in all other months of the years as shown in the (Table No.1and Figure No.1).

During the study period the incidence of *Trichuris trichura* was highest in July with 24.98 percent and lowest in the month of November 04.52 percent. A gradual fall in the incidence of *Trichuriasis* was also found in all other months as shown in the (Table No.2 and Figure No.2).

Hookworm registered the highest incidence in the month of June 48.95 and lowest in the month of August 15.68 percent.A gradual fall in the incidence of *Trichuriasis* was also found in all other months as shown in the (Table No.3 and Figure No.3).

The average rainfall in these months relative humidity observed was also high with mean percentage values ranging from 95.08 ± 3.27 to 112.02+18.99 mm. the relative humidity observed were also high with mean percentage value ranging for the study period.

Comparatively low incidence was observed during the hot dry months of February, March, April and May. Average incidence of these of these intestinal helminths was noted in the months of November, December, and January during the study period. The soil-transmitted helminthic infection in Aurangabad district was highly found in rainy season, followed by the winter season and low in summer season.

Discussion:

An important outcome of our investigation is the observation that intestinal helminth infections were not independent of one another, and that some species co-occurred more frequently than might have been expected if their occurrences were by chance. Though this pattern of interaction, especially the co-occurrence of *A. lumbricoides* and *T. trichiura* have been described previously [13a, 13b, 14, 15, 16 and 17], this is the first time that a significant co-infection of hookworm and *T. trichiura*, and *A. lumbricoides* and *T. trichiura* is reported.

Regarding the other helminth species, similar associations have been found previously, such as in Brazil [18] and [15]. In both studies, co-infections of schistosomes and intestinal nematodes were very common. In Brazil, significant associations between hookworm infection and intestinal schistosomiasis and of hookworm infection and ascariasis were found; intensity of hookworm infection increased with multiplicity of infections [18].

Maximum survival rates of hookworm larvae, as indicated by proportion of larvae surviving, occur at 20-30 °C. Experimental studies suggest that maximum development rates of free-living infective stages occur at temperatures between 28 and 32 °C, with development of *A. lumbricoides*and *T. trichiura*arresting below 5 and above 38 °C [19, 20], and development of hookworm larvae ceasing at 40 °C [21, 22]. It is suggested that *A. lumbricoides*eggs are more resistant to extreme temperatures than *T. trichiura*eggs [23].

Soil moisture and relative atmospheric humidity are also known to influence the development and survival of ova and larvae: higher humidity is associated with faster development of ova; and at low humidity (<50%) the ova of *A. lumbricoides*and *T. trichiura*do not embryonate [24, 25]. Field studies show that the abundance of hookworm larvae is related to atmospheric humidity [26, 27].

These differing rates of development and survival will influence parasite establishment in the human host and hence the infection levels. Thus, a climate-induced increase in the rate of establishment, while holding parasite mortality constant, causes the parasite equilibrium to rise [23]. Although seasonal dynamics in transmission may occur, such fluctuations may be of little significance to the overall parasite equilibrium within communities. For all these reasons, spatial variability in long-term synoptic environmental factors will have a greater influence on transmission success and patterns of STH infection than seasonal variability in a location.

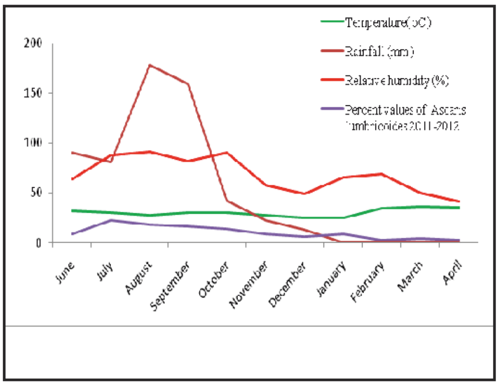


Figure No. 1: The prevalence of Ascaris lumbricoides in relation to Air temperature, rainfall and relative humidity recorded during June 2011 to May 2012.

Table No. 1: The prevalence of Ascaris lumbricoides in relation to Air temperature, rainfall and relative humidity recorded during June 2011 to May 2012.

Month	Temperature(°C)	Rainfall (mm)	Relative humidity (%)	Percent values of *Ascaris lumbricoides* 2011-2012
June	32.17 ± 0.28	90.08 ± 3.89	64.00 ± 8.34	8.59
July	30.12 ± 0.25	80.64 ± 10.45	88.00 ± 3.75	22.58
August	28.25 ± 0.29	178.08 ± 30.78	91.56 ± 5.19	25.69
September	30.35 ± 0.18	159.02 ± 18.44	81.57 ± 4.49	16.58
October	30.24 ± 0.24	42.06 ± 25.58	91.00 ± 4.45	14.28
November	28.36 ± 0.17	22.00 ± 13.36	58.06 ± 9.41	8.97
December	25.54 ± 0.21	12.58 ± 0.74	48.98 ± 4.55	6.58
January	25.47 ± 0.13	00.00 ± 00.00	65.08 ± 3.41	8.52
February	34.25 ±0.14	00.00 ± 00.00	69.06 ± 4.58	2.96
March	36.24 ± 0.24	00.00 ± 00.00	49.87 ± 5.22	4.93
April	35.35 ± 0.22	00.00 ± 00.00	41.14 ± 17.05	2.86
May	42.47 ±0.11	00.00 ± 00.00	44.06 ± 25.44	1.96

Table No.2: The prevalence of Trichuris Trichura in relation to Air temperature, rainfall and relative humidity recorded during June 2011 to May 2012 in 547 stool samples.

Month	Temperature (°C)	Rainfall (mm)	Relative humidity (%)	Percent values of *Trichuris Trichura* 2011-2012
June	32.17 ± 0.28	90.08 ± 3.89	64.00 ± 8.34	15.98
July	30.12 ± 0.25	80.64 ± 10.45	88.00 ± 3.75	24.98
August	28.25 ± 0.29	178.08 ± 30.78	91.56 ± 5.19	21.04
September	30.35 ± 0.18	159.02 ± 18.44	81.57 ± 4.49	15.28
October	30.24 ± 0.24	42.06 ± 25.58	91.00 ± 4.45	05.76
November	28.36 ± 0.17	22.00 ± 13.36	58.06 ± 9.41	04.52
December	25.54 ± 0.21	12.58 ± 0.74	48.98 ± 4.55	---
January	25.47 ± 0.13	00.00 ± 00.00	65.08 ± 3.41	---
February	34.25 ±0.14	00.00 ± 00.00	69.06 ± 4.58	---
March	36.24 ± 0.24	00.00 ± 00.00	49.87 ± 5.22	---
April	35.35 ± 0.22	00.00 ± 00.00	41.14 ± 17.05	---
May	42.47 ±0.11	00.00 ± 00.00	44.06 ± 25.44	---

Figure No. 2: The prevalence of Trichuris Trichura in relation to Air temperature, rainfall and relative humidity recorded during June 2011 to May 2012.

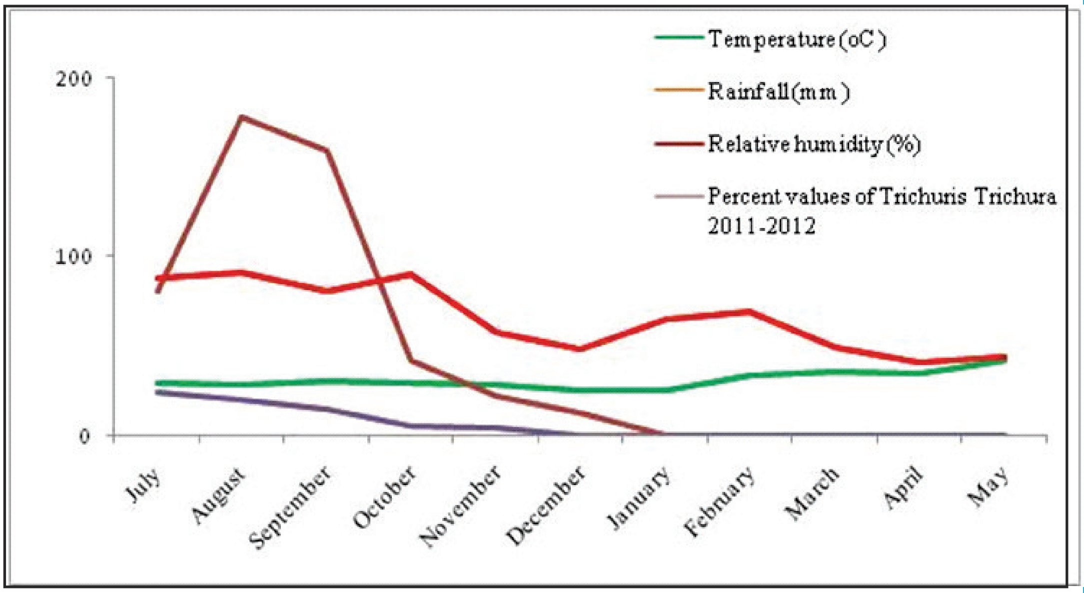
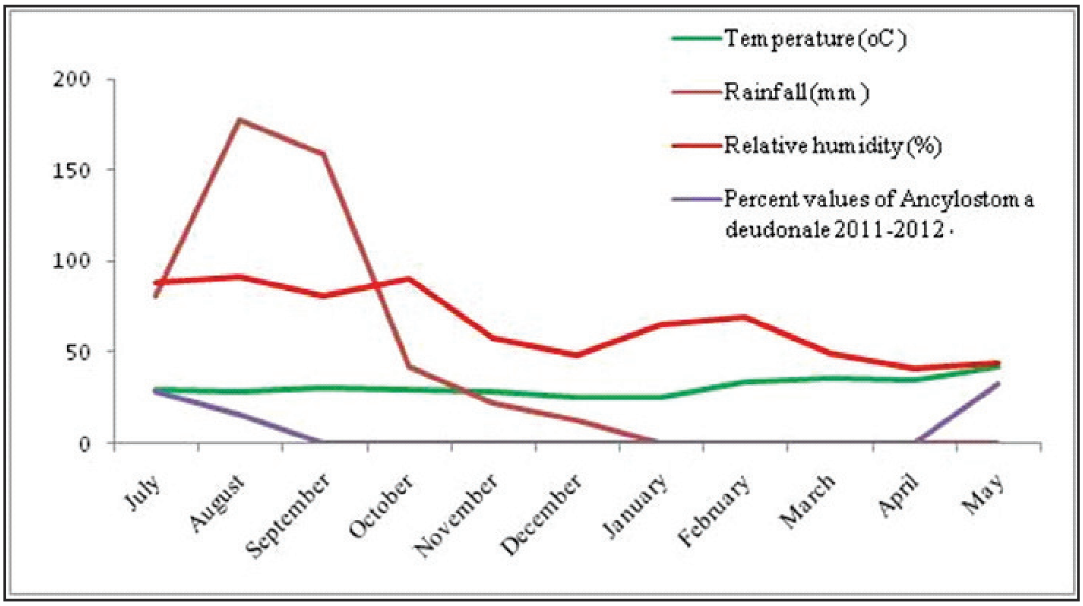


Table No. 3: The prevalence of Hookworm Ancylostoma deudonale in relation to temperature, rainfall and relative humidity recorded during June 2011 to May 2012 in 547 stool samples.

Month	Temperature (°C)	Rainfall (mm)	Relative humidity (%)	Percent values of *Ancylostoma deudonale* 2011-2012
June	32.17 ± 0.28	90.08 ± 3.89	64.00 ± 8.34	48.95
July	30.12 ± 0.25	80.64 ± 10.45	88.00 ± 3.75	27.87
August	28.25 ± 0.29	178.08 ± 30.78	91.56 ± 5.19	15.68
September	30.35 ± 0.18	159.02 ± 18.44	81.57 ± 4.49	---
October	30.24 ± 0.24	42.06 ± 25.58	91.00 ± 4.45	---
November	28.36 ± 0.17	22.00 ± 13.36	58.06 ± 9.41	---
December	25.54 ± 0.21	12.58 ± 0.74	48.98 ± 4.55	---
January	25.47 ± 0.13	00.00 ± 00.00	65.08 ± 3.41	---
February	34.25 ±0.14	00.00 ± 00.00	69.06 ± 4.58	---
March	36.24 ± 0.24	00.00 ± 00.00	49.87 ± 5.22	---
April	35.35 ± 0.22	00.00 ± 00.00	41.14 ± 17.05	---
May	42.47 ±0.11	00.00 ± 00.00	44.06 ± 25.44	32.11

Figure No. 3: The prevalence of Hookworm Ancylostoma deudonale in relation to temperature, rainfall and relative humidity recorded during June 2011 to May 2012.



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