



## PREVALENCE MAPPING OF SOIL TRANSMITTED HELMINTHS IN NORTH EASTERN STATES OF INDIA – FIRST REPORT.

### Parasitology

|                          |                                                                                                                                                                      |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Sandipan Ganguly*</b> | Division of Parasitology, ICMR-National Institute of Cholera and Enteric Diseases, P33 CIT Road, Scheme XM, Kolkata 700010, West Bengal, India *Corresponding Author |
| <b>Ajanta Ghosal</b>     | Division of Parasitology, ICMR-National Institute of Cholera and Enteric Diseases, P33 CIT Road, Scheme XM, Kolkata 700010, West Bengal, India                       |
| <b>Rituparna Sarkar</b>  | Division of Parasitology, ICMR-National Institute of Cholera and Enteric Diseases, P33 CIT Road, Scheme XM, Kolkata 700010, West Bengal, India                       |
| <b>Sumallya Karmakar</b> | Division of Parasitology, ICMR-National Institute of Cholera and Enteric Diseases, P33 CIT Road, Scheme XM, Kolkata 700010, West Bengal, India                       |
| <b>Shanta Dutta</b>      | Division of Parasitology, ICMR-National Institute of Cholera and Enteric Diseases, P33 CIT Road, Scheme XM, Kolkata 700010, West Bengal, India                       |

### KEYWORDS

#### INTRODUCTION

Soil transmitted helminthiasis (STH) is a major health problem in tropical and subtropical regions of the world, with 1.5 billion people affected worldwide. [1] There are four intestinal nematode species, namely roundworm (*Ascaris lumbricoides*), the whipworm (*Trichuris trichiura*), and the hookworms (*Necator americanus* and *Ancylostoma duodenale*), that fall under the group of soil transmitted helminths. [2] Sub-Saharan Africa, East Asia, China, India and South America, contribute highest number of STH infections in the world. WHO estimates show that > 1.2 billion people are affected with ascariasis. Trichuriasis and hookworm infection have been estimated to be ~700–800 million each, globally. [3] The warm and moist climate of tropics and subtropics favours hatching and embryonation of the eggs. Soil contaminated with the egg or larvae leads to widespread infection of all the STH. [2] Besides, inadequate sanitation, open defecation, poor hygiene practices and socio-economic status in those countries contribute to high disease burden among population. STH infections causes nutritional deficiency, anaemia, growth retardation and impaired cognitive development which may result in absenteeism and disability adjusted life years (DALYs) loss. [2,4] School age children (SAC) are very much prone to be affected and normally harbour worm burdens greater than adults. According to WHO estimation, over 267 million preschool-age children and over 568 million school-age children are at risk of STH infection worldwide, of which 241 million are from India alone. [1, 4] WHO recommended annual or biannual school-based deworming can be an effective strategy to control infection in SAC. [4] Most of the studies on STH epidemiology in India have been carried out in northern, western and southern parts of this country. Currently there is limited information available on the STH disease burden in the North-eastern states viz. Assam, Manipur, Mizoram, Arunachal Pradesh, Meghalaya, Tripura and Nagaland. This pilot study, was conducted among the children studying in government primary schools in those states in order to generate a preliminary estimate of current prevalence and intensity of STH which would help in formulating deworming frequency.

#### MATERIALS AND METHODS

##### 2.1. Ethics, and Permission

Permission to conduct the survey in selected schools had been obtained from Ministry of Health & Family Welfare, Govt. of India as well as of each individual states and also from Ministry of Secondary Education of each state. This cross-sectional study was designed according to WHO recommendations and approved by Division of Parasitology, ICMR-National Institute of Cholera and Enteric Diseases (NICED), Kolkata. Written consent was obtained from the guardians prior to including the school children in the survey.

##### 2.2. Study setting

The North-east of India originally comprises 7 sister states viz. Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland,

Tripura and Assam. As per 2011 census the total population of Northeast India is around 45 million.

##### 2.3. Sampling procedure and sample size

For collection of data, WHO recommended Sentinel site Approach was followed. A list of randomly selected primary schools from both rural and urban areas in each state was prepared. Fifty students (age group 5-12 years), who were present on the day of survey, were selected at random from each school.

##### 2.4. Data collection

The study was conducted by Division of Parasitology, ICMR-NICED, Kolkata, during December, 2015- February, 2016. The field team demonstrated the aim, objective and procedure of fresh stool sample collection to the Head of the respective school and to the guardians of all the participants. Guardians and participants both were interviewed for relevant information like sanitation system, drinking water system, house condition, family income etc.

##### 2.5. Sample collection

Fresh stool sample, defecated in the morning, was collected in a plastic screw cap bottle. Bottles were put in a zip lock bag and delivered to the temporary laboratory facility in ice box within an hour of collection.

##### 2.6. Stool sample processing

The sample was processed using the Vestergaard Frandsen Kato-Katz kit following the manufacturer's protocol [5]. Two slides were prepared for each sample and were checked for the helminth egg. From the slide count egg per gram was calculated to measure the intensity of the worm infection.

##### 2.7. Quality control

For the purpose of quality control, 10% slides were rechecked. An independent expert also reviewed the slides and survey procedure as well.

##### 2.8. Data analysis

Excel 2010 were used to calculate the prevalence and to prepare graphical representation of the collected data.

#### RESULTS

The cross-sectional study, included 20 primary schools in 7 Northeast states, majority of which were in rural areas, with a source of drinking water and toilet facilities within the premises. A total of 1116 individuals was enrolled in this survey, out of which 1071 (96%) faecal samples were properly collected and transported for examination, following the sample acceptance criteria. Rest of the samples (45) were rejected as they did not pass the acceptance criteria.

All of the study participants were in the age group of 5-12 years. 531

(49.58%) male and 540 (50.42%) female participants were included in the study. 55.1% of male and 51.8% of female students were found infected.

Monthly income of 34% family of the study population was in the range of 5000-10000 INR whereas 12% individuals came from a family with monthly income of >10000 INR. 54% family belongs to a very poor economic background with less than 5000 INR income per month. Majority (79%) of the children practised open defecation due to lack of a household latrine.

In this study 573 children, i.e. 53.50% of total study population were found to be infected with one or more soil transmitted helminths. In Assam the prevalence of common STH infection was 49.67% whereas Arunachal Pradesh showed a prevalence of about 61.2%. In Manipur and Meghalaya, the overall prevalence was comparable with each having infection rate around 49%. Mizoram had 54.71% infected children while neighbouring state Tripura showed the least infection rate (i.e. 45%) among all. Nagaland turned out to be the most affected state carrying the highest percentage of affected children i.e. 64.54% (Figure- 1).

Our study showed infection with *Ascaris lumbricoides* was most prevalent with an overall infection rate of 50.21% followed by *Trichuris trichiura* infection (8.47%) and Hookworm infection (4.76%).

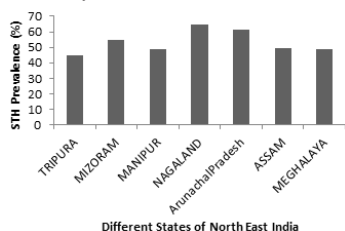
Around 17% of the children was infected with more than one helminths whereas only 1% of the total population harboured triple infection. Almost all infections were of light intensity.

A detailed study showed varied rate of STH prevalence in different states. Assam had *Ascaris* infection rate of 48%, whipworm infection rate of 7.8% and hookworm infection rate of 3.6%. In Arunachal Pradesh, 56% of individuals were ascariasis affected, 12.4% individuals harboured whipworm infection and 6.8% of individuals were infected with hookworm. The prevalence of *Ascaris lumbricoides*, *Trichuris trichiura* and Hookworm in Manipur were 45%, 3% and around 4%, respectively. Meghalaya showed highest prevalence of whipworm with infection rate around 20%. Ascariasis and hookworm affected cases were 46% and 5.3% respectively. Mizoram had *Ascaris* infection rate of 51%, whipworm infection rate of 5.66% and hookworm infection rate of 3.77%. Nagaland had highest cases of both ascariasis (60%) and hookworm infection (6.36%). In Tripura, the prevalence of *Ascaris lumbricoides*, *Trichuris trichiura* and Hookworm were 42%, 8% and around 4%, respectively (Figure- 2).

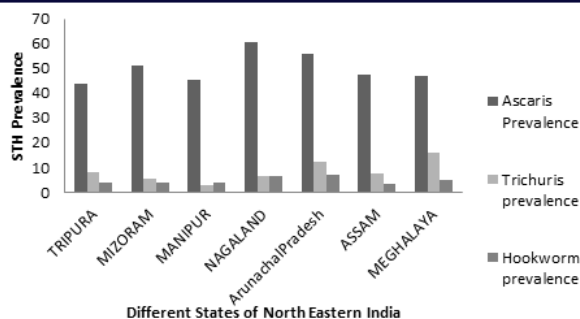
The study population was divided into three age groups; ≤6, 7-10 and >10 years. The STH prevalence in the above groups were as follows: 65.8% in ≤6years, 51.5% in 7-10years and 55% in >10years (Figure- 3).

## 5. CONCLUSIONS

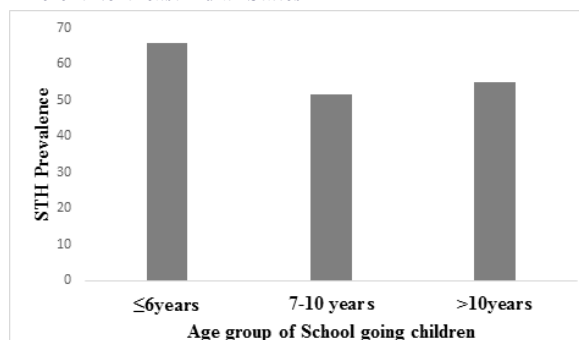
The STH prevalence in seven North-eastern states of India was variable ranging from 45%- 64.54%. Among the three age groups, individuals of ≤6 years were found to be most affected. As per WHO recommendation, the risk groups in areas with above 50% of prevalence should be treated bi-annually with anti-helminthic drugs to control and minimize the burden of infection [6]. According to this pilot study, bi-annual school-based deworming is obligatory for the Northeast states along with the implementation of health and hygiene education in primary schools. For complete eradication of STH, each of the individual State Government should undertake long term strategies to improve the conditions of drinking water and sanitation system of the community.



**Figure 1: Percentage of overall STH Prevalence in Different Northeast Indian States**



**Figure 2: Percentage of individual helminth prevalence (Ascariasis, Trichuriasis and Hookworm infection cases) in Different Northeast Indian States**



**Figure 3: STH Prevalence in different age groups of children in the study population**

## REFERENCES

- [1] World Health Organisation. Soil-transmitted helminth infections. 2019. <https://www.who.int/news-room/fact-sheets/detail/soil-transmitted-helminth-infections>.
- [2] Karshima SN. Prevalence and distribution of soil-transmitted helminth infections in Nigerian children: a systematic review and meta-analysis. *Infect Dis Poverty*. 2018; 7: 69. doi:10.1186/s40249-018-0451-2
- [3] Silva NR, Brooker S, Hotez PJ, Montresor A, Engels D, Savioli L. Soil-transmitted helminth infections: Updating the global picture. 2003. *Trends Parasitol*. 19: 547-551. doi:10.1016/j.pt.2003.10.002
- [4] Ganguly S, Barkataki S, Karmakar S, Sanga P, Boopathi K, Kanagasabai K et al. High prevalence of soil-transmitted helminth infections among primary school children, Uttar Pradesh, India, 2015. 2017. *Infect Dis Poverty*. 6: 139. doi:10.1186/s40249-017-0354-7
- [5] WHO. Basic laboratory methods in medical parasitology. Geneva: World Health Organization; 1991.
- [6] World Health Organization. Soil-transmitted helminthiasis. Number of children (Pre-SAC and SAC) requiring Preventative Chemotherapy for soil transmitted helminthiasis, 2010 [accessed April 2017]. [http://apps.who.int/neglected\\_diseases/ntddata/sth.html](http://apps.who.int/neglected_diseases/ntddata/sth.html).