

## Assessment of prevalence of soil-transmitted helminthic infection by WHO recommended Kato-Katz method in five districts of Jharkhand

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### ABSTRACT

**Aims:** Soil-transmitted helminthes (STH) namely roundworms, whipworms and hookworms, affect more than two billion people worldwide. The gastrointestinal tract of a child living in poverty in a less developed country is likely to be infected with at least one of three soil-transmitted helminthes leading impairments of physical and cognitive development. We aimed to estimate the prevalence of STH infection in five districts of Jharkhand namely Gumla, West Singhbhum, Palamu, Pakur and Koderma selected as sentinel sites by World Health Organization (WHO).

**Methodology:** We examined stool samples of 287 children aged between 9-10 years from seven schools of five districts in December 2015. WHO recommended Kato-Katz technique was used for STH prevalence estimation. Information regarding socio-demographic variables and personal hygiene practices was also recorded. Chi-square test was used to study association of risk factors with STH infection.

**Results:** A total of 123 (42.9%) children were found to be positive for the STH infection. Among positive samples, all were having *Ascaris lumbricoides* (roundworm) infection whereas 5.9% and 1.7% were co-infected with hookworm and *Trichuris trichiura* (whipworm) respectively. Factors like absence of household latrine and lack of hand washing before meals were significantly associated with occurrence of STH infection.

**Conclusion:** STH infection is a significant problem among school children in the studied area and may contribute to anemia and malnutrition. It is needed to focus on creating awareness regarding hand washing practices before meals and access to household latrine.

**Keywords:** *Ascaris lumbricoides*, *Trichuris trichiura*, *Ancylostoma duodenale*, Soil-transmitted helminthes

## I.INTRODUCTION

Soil-transmitted helminthes (STH), namely roundworms, whipworms and hookworms, affect about 1.5 billion people worldwide [1]. 300 million suffer from associated severe morbidity [1]. Common STHs cause global disease burden of about 39 million disability-adjusted life years (DALY) [2]. At least one, and in many cases all three soil-transmitted helminthes likely to infect gastrointestinal tract of every child living in less developed country, this may cause impairments of physical, intellectual and cognitive development [2]. The objective of the survey was to estimate the prevalence of soil transmitted helminthes infection in five selected districts of Jharkhand.

In developing country like India, STH infection accounts for about 27% of the world's STH burden and having over 241 million children in need of deworming. *Ascaris lumbricoides* (roundworm, AL), *Ancylostoma duodenale* (Hookworm, HW), *Trichuris trichiura* (whipworm, TT) infections are common in India although their individual prevalence rates vary. It has been suggested to target school children aged 9-10 years to assess STH prevalence rate for planning and monitoring STH control activities in the community [3].

## II.MATERIALS AND METHODS

**2.1 Study population:** World Health Organization (WHO) selected five sentinel sites in districts namely Gumla, West Singhbhum, Palamu, Pakur and Koderma of Jharkhand state (one sentinel site in each district). Based on WHO recommendations, it was targeted to cover minimum of 50 stool samples from each site. Schools were randomly selected from the list of all primary schools in each selected district. At each sentinel site, about 100 students of age group 9-10 years were provided with stool carrying container on day one and samples were collected and examined on day two. Total seven schools were selected. All were government schools and of co-education module.

**2.2 Study design and Setting:** The present study was conducted by Department of Parasitic Diseases, National Centre for Disease Control, Delhi. Health personals from the institute briefed the school heads & teachers about the survey. Necessary permissions were obtained from Health and Education Departments of each district and the Principals of surveyed schools. The entire survey was done during the period 30<sup>th</sup> November 2015 to 11<sup>th</sup> December 2015. School children were educated regarding causes, consequences & control of STH infections and importance of maintaining proper sanitation and personal hygiene.

Information regarding height and weight of each participant, personal hygiene, history of passage of worms, use of household latrines, practice of hand washing before meals and after defecation and source of water supply were recorded with the help of pretested questionnaire. Students were also examined for presence of unclean nails. Each participant was provided with a stool collection vial and was demonstrated the method of stool sample collection and transportation. Students were asked to bring sample of fresh stool. On day two, vials were collected from students and transported to the parasitology laboratory at District Hospital of the selected area for further processing and examination for the presence of helminthic eggs.

**2.3 Parasitological Examination:** Stool samples were examined using the WHO recommended Kato-Katz technique. Kits used in the technique had a template that used to deliver 41.7 mg of stool sample on to the slide. Samples were examined for the eggs of *Ascaris lumbricoides*, *Ancylostoma duodenale* and *Trichuris trichiura*. The number of eggs per slide (EPS) obtained after microscopic examination of each slide were further multiplied by a common factor of 24 to obtain eggs per gram (EPG) of stool [4].

**Categorization of intensity of infection:** As per WHO recommendations, calculated eggs per gram of stool have been used for the categorization of intensity of STH infection into three different categories viz. mild, moderate and heavy. For AL infection, EPG counts of ranges 1-4999, 5000-49999 and  $\geq 50000$  represents mild, moderate and heavy infections respectively [4]. For HW infection, EPG counts of ranges 1-1999, 2000-3999 and  $\geq 4000$  represents mild, moderate and heavy infections respectively [4]. For TT infection, EPG counts of ranges 1-999, 1000-9999 and  $\geq 10000$  represents mild, moderate and heavy infections respectively [4].

**2.4 Quality control:** Quality control measures were instituted to ensure the consistency and accuracy of microscopic readings. All microscopists were trained about Kato-Katz technique and differentiation of stained helminthic eggs on the basis of their specific morphology. All slides positive for STH and 10% of slides negative for STH were re-examined by another expert independently. An inter-reader variation of upto 10% of number of eggs was considered acceptable.

**2.5 Statistical examination:** Data were entered and analyzed using Microsoft Excel & Epi-Info statistical software (Version 3.5.1). Associations of various risk factors with the prevalence of STH infection were studied by applying Chi-square test (with Yate's correction). P value of  $<0.05$  was considered to be statistically significant.

### III. RESULTS

Out of the total 287 stool samples examined, 123 samples (42.9%) were found to be positive for any helminthic egg. AL was found in all positive samples, HW was found in 17 (5.9%) samples and TT was found in 5 (1.7%) samples. Majority (84.5%) of STH infected children were only infected with AL (monoparasitism) whereas remaining children were having two (AL+TT & AL+HW) types of helminthic infection (polyparasitism). Mean eggs per gram (EPG) of AL, HW and TT were found to be 140, 5 and 1.5 respectively (Table 1).

**District-wise prevalence of STH infection:** At Gumla, prevalence of STH, AL and HW were 36.5%, 36.5% and 12.7% respectively whereas no case of TT infection was found. At West Singhbhum, prevalence of STH, AL, HW and TT were 79.1%, 79.1%, 8.9% and 4.5% respectively. At Palamu, prevalence of STH was 17.6% having AL positive cases only. At Pakur, prevalence of STH, AL, HW and TT were 60.7%, 60.7%, 5.4% and 3.6% respectively. At Koderma, prevalence of STH was 8% having AL positive cases only (Table 2). Thus, West Singhbhum was having highest STH prevalence whereas Koderma was recorded least STH prevalence (Fig. 1).

Majority (63.4%) of the participants were females. Majority of children were having untrimmed nails, clean cloths, tap water as major source of drinking water supply, household latrine, habit of consistent use of footwear at home, habit of not washing hands before meal, having practice of eating food items fallen on ground, habit of playing in the soil and habit of washing hands after defecation (Table 3).

Factors like lack of household latrine ( $P=0.0001$ ), unsafe source of drinking water ( $P=0.0001$ ) and not washing hands before meal ( $P=0.0001$ ) were found significantly associated with occurrence of STH infection (Table 3).

#### **IV.DISCUSSION**

STH infections can easily transmit through contaminated food, water and soil and may contribute to major portion of disease burden of the community. In India, overall prevalence of STH infections have been reported to range between 7.56% and 78.27% in different studies and these infections have mostly been polytypic in nature [5]. Current study depicts the nature of STH infection in most of the cases as monotypic. Climatic and soil conditions of the selected area widely influence STH infections supporting the need of mapping the STH infection on the basis of agro-climatic zones [3, 6]. According to division of districts of Jharkhand on the basis of agro-climatic zones, Palamu and Gumla fall in Western Plateau Zone, Pakur and Koderma in Central and North Eastern Plateau Zone and West Singhbhum in South Eastern Plateau Zone. West Singhbhum reported to have uneven annual rainfall distribution throughout the year was found having the highest STH prevalence rate [7] (Fig. 1).

In present study, practicing unhygienic habits among study participants like not washing hands before meals had significantly associated with high STH prevalence rate. Other studies have also reported that not washing hands before meals [8, 9] and eating food fallen on ground [10, 11] are significant risk factors for acquiring STH infection among school children.

We also found that lack of household latrine and unsafe source of drinking water had significantly associated with the STH infection load in participants. Some studies have also mentioned the importance of safe source of drinking water in retarding the expansion of STH infection in the community [12]. In addition, coupling deworming strategy with proper sanitation facilities like access to household latrine may yield more sustained reductions in STH prevalence rate in the community [13]. Under Swachhh Bharat Mission, Government of India is stressing on construction of household latrines and making open defecation free environment. This may aid in achieving the goal of reducing STH infection in the community in future.

#### **V.CONCLUSION**

In the present study, lack of hand washing practices, non-usage of household latrine and unavailability of safe source of drinking water was significantly associated with STH burden in the studied population. Therefore, it is suggested that multipronged approaches may be used in conjunction with deworming activities for sustained effect on STH control. This may include providing health education to the community on hand washing

practices, focus on improvement of overall sanitation and hygiene by access to household latrine and provision of safe drinking water to the community.

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**Table 1. Characteristics of soil-transmitted helminthic (STH) infection in the state of Jharkhand (all sentinel sites).**

Characteristics of infection	No. (%)
Schools surveyed	7
Samples examined	287
%Prevalence of STH (n)	123 (42.9%)
%Prevalence of <i>Ascaris lumbricoides</i> (n)	123 (42.9 %)
%Prevalence of <i>Ancylostoma duodenale</i> (n)	17 (5.9%)
%Prevalence of <i>Trichuris trichiura</i> (n)	5 (1.7%)
Mean epg of <i>Ascaris lumbricoides</i>	140
Mean epg of <i>Ancylostoma duodenale</i>	5
Mean epg of <i>Trichuris trichiura</i>	1.5
Monotypic infection	104 (84.5%)
Polytypic infection	19 (15.5%)

Name of District	No. of schools surveyed	No. of samples examined	%Prevalence of STH (n)	%Prevalence of AL (n)	%Prevalence of HW (n)	%Prevalence of TT (n)	Mean eggs per gram
Gumla	1	63	36.5 (n=23)	36.5 (n=23)	12.7 (n=8)	Zero	122.09
West Singhbhum	2	67	79.1 (n=53)	79.1 (n=53)	8.96 (n=6)	4.48 (n=3)	553.36
Palamu	2	51	17.65 (n=9)	17.65 (n=9)	Zero	Zero	66.67
Pakur	1	56	60.71 (n=34)	60.71 (n=34)	5.36 (n=3)	3.57 (n=2)	264
Koderma	1	50	8 (n=4)	8 (n=4)	Zero	Zero	42

**Table 2. District-wise prevalence and intensity of soil-transmitted helminthic (STH) infection in studied sites of Jharkhand**

**Table 3. Risk factors associated with STH infection among studied population**

S. No.	Risk Factor	Non-Infected (n) (%)	Infected (n) (%)	Total	$\chi^2$	P value
<b>1.</b>	<b>Gender</b>					
	Male	59 (35.5%)	46 (37.4%)	105	0.15	0.69
	Female	105 (64.1%)	77 (62.6%)	182		
<b>2.</b>	<b>Age-Group</b>					
	≤10 yrs.	79(48.2%)	55 (44.7%)	134	0.07	0.78
	>10 yrs.	85 (51.8%)	68 (55.3%)	153		
<b>3.</b>	<b>Untrimmed nails</b>					
	Present	98 (59.7%)	71 (57.7%)	199	0.05	0.82
	Absent	66 (40.3%)	52 (42.3%)	88		
<b>4.</b>	<b>Clean Cloths</b>					
	Present	156 (95.1%)	116 (94.3%)	272	0.00	0.96
	Absent	8 (4.9%)	7 (5.7%)	15		
<b>6.</b>	<b>Source of drinking water</b>					
	Tap water	80 (48.8%)	70 (56.9%)	150	17.9	<b>0.0001</b>
	Tanker	56 (34.1%)	51 (41.5%)	107		
	Others	28 (17.1%)	2 (1.6%)	30		
<b>7.</b>	<b>Household Latrine</b>					
	Present	110 (67.1%)	121 (98.4%)	231	41.8	<b>0.0001</b>
	Absent	54 (32.9%)	2 (1.6%)	56		
<b>8.</b>	<b>Treatment for worms</b>					
	Yes	77 (46.9%)	68 (55.3%)	145	2.24	0.13
	No	87 (53.1%)	55 (44.7%)	142		
<b>9.</b>	<b>Consistent use of footwear at home</b>					
	Yes	84 (51.2%)	75 (60.9%)	159	2.32	0.13
	No	80 (48.8%)	48 (39.1%)	128		
<b>10.</b>	<b>Washing hands before meal</b>					
	Yes	38 (23.2%)	92 (74.8%)	130	76.3	<b>0.0001</b>
	No	126 (76.9%)	31 (25.2%)	157		
<b>11.</b>	<b>Practice of eating food fallen on ground/unwashed vegetables/fruits</b>					

	Yes	112 (68.3%)	73 (59.3%)	185	2.08	0.15
	No	52 (31.7%)	50 (40.7%)	102		
<b>12.</b>	<b>Eat soil/play with soil</b>					
	Yes	99 (60.4%)	77 (62.6%)	176	0.28	0.59
	No	65 (39.6%)	46 (37.4%)	111		
<b>13.</b>	<b>Washing hands after defecation</b>					
	Yes	133 (81.1%)	110 (89.4%)	243	3.14	0.08
	No	31 (18.9%)	13 (10.6%)	44		

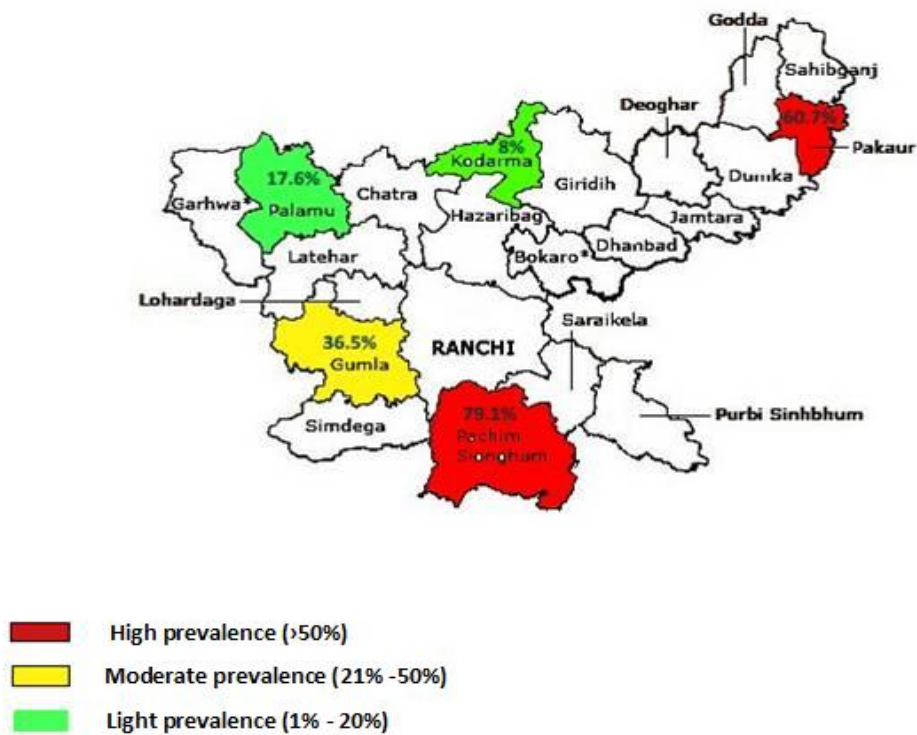


Figure 1. Prevalence of soil-transmitted helminth infection in selected sentinel sites in five districts of Jharkhand state.