

Rapid Assessment of Soil Transmitted Helminth (STH) Infections among School Girls in Odisha

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Abstract

Soil Transmitted helminthes are a preventable yet frequently seen infections among children, more deleterious for girls in adolescent age groups as it compounds to the iron deficiency anemia seen in most of them. Different states in India do periodic deworming to curb this menace. The present study is done in three different ecological districts of Odisha namely Angul, Khurda and Rayagada among school going girls in their early adolescence i.e. 10-14 years of age in order to make a dipstick assessment of the worm load in the rural and underserved i.e. tribal adolescent school going girls. The worm prevalence is seen to be 29.7% out of which nearly 21% is caused by hookworms. Personal hygiene and open field defecation besides lack of routine programmatic services are seen as some of the attributing factors.

Keywords: Soil transmitted helminth infections; Hand washing; Iron deficiency anemia

Introduction

Soil-transmitted helminths (STH) infections are among the most common infections worldwide and affect the poorest and most deprived communities. They are transmitted by eggs present in human faeces which in turn contaminate soil in areas where sanitation is poor. The main species that infect people are the roundworm (*Ascaris lumbricoides*), the whipworm (*Trichuris trichiura*) and the hookworms (*Necator americanus* and *Ancylostoma duodenale*) [1]. A number of studies have suggested that even a moderate intensity of infection may result in delayed physical growth and impaired cognitive development, particularly among children of school-going age [2,3] and STH infections are considered a leading cause of sickness, absenteeism and disability adjusted life years (DALYs) lost [4]. In India, the reported prevalence of STH ranges from 12.5-66 per cent, with varying prevalence rates for individual parasites [5-7].

Iron deficiency anemia is thought to affect the health of more than one billion people worldwide, and it is the most common form of anemia in the developing world [8]. This accounts for most of the anemia that occurs due to parasitic infections. Most seriously affected are young children and women in less developed countries [9]. For girls in countries like India, this often compounds to the problem of severe anemia due to other reasons like menstruation, nutritional deficiency, early marriage and early childbirth; and hence if prevented can decrease morbidity. Thus under the National Programmes, 100 Iron Folic Acid (IFA) tablets are provided for all adolescent girls once in a year to be taken once in a day for three months.

STH infections are also common in these girls and boys alike because of social habits like open field defecation, walking barefoot and lack of safe water. The government therefore also provides 400 mg of albendazole (anthelmintics) under School Health programmes to the children.

The state of Odisha, is one of the Empowered Action Group i.e. EAG states of India, which means states that have had consistent poor demographic indicators since independence and now are prioritized by the country to have reinforced programmatic interventions and thus special budgetary allocations. It has an area of 155,707 sq. km. and a population of 36.80 million. There are 30 districts, 314 blocks and 51349 villages. The State has population density of 236 per sq. km. (as against the national average of 312). The Infant Mortality Rate is 69 and Maternal Mortality Ratio is 303 (SRS 2004 - 2006) which are higher than the National average and nearly 47.15% of its population living below the poverty line and anemia in women of reproductive age groups was seen to be nearly 65% in NHFS-3 (National Health Family Survey) study.

Hence a rapid epidemiological survey among school-age adolescent girls conceived by partners UNICEF and Kalinga Institute of Medical Sciences, Bhubaneswar (KIMS) in 2010 which was done to decide upon the strategy of mass deworming of children under the School Health Programme annually. The state already had a provision for this and the study was initiated to evaluate whether the exercise was being done and its effectiveness in the school going girls cohort.

Research Questions

- What is the prevalence of STHs in the adolescent girls school children (10-14 years).
- What are the possible risk factors that attribute to the STHs in the current study environment.
- To suggest feasible strategies to reduce the risk of infection in the said cohort.

Methodology

It was a Descriptive Cross-sectional study planned between Dec 2010 to Feb 2011, the target population being Girl School children from 10-14 years of age (early adolescence) of selected districts of state of Odisha. The study was funded by UNICEF Nutrition Division,

Bhubaneswar and was a part of a rapid assessment, done to assess the deworming programme in the state.

The state of Odisha has 30 districts and, as per ecological as well as administrative convenience, the districts are divided into three zones- Coastal, Western and KBK zones. Ecological criteria were chosen for stratification of the districts, as STH infections have been seen to have a predilection for the nature of soil in regions [10]. The results of the study were expected to help the state formulate a revised deworming strategy uniformly for the whole state; nevertheless an ecological impression regarding prevalence of STH in zones would help give pointers towards piloting or prioritizing districts for the implementation of the strategy. Thus the 30 districts were stratified as follows:

- Coastal Zone: Cuttack, Khurda, Jajpur, Bhadrak, Balasore, Jagatsinghpur, Kendrapara, Ganjam, Puri, Mayurbhanj, Nayagarh
- Western Zone: Sambalpur, Sundergarh, Bargarh, Deogarh, Sonepur, Boudh, Jharsuguda, Dhenkanal, Angul, Keonjhar
- KBK Zone: Koraput, Malkangiri, Rayagada, Nowrangpur, Kalahandi, Kandhamal, Gajapati, Bolangir, Nuapara

For selection of the study subject, sampling was multiphasic stratified simple random.

First Phase: Final selection of the study districts was done by random sampling and 3 districts out of the total 30 districts in the state were selected by the random table method. Three different ecological zones of state were selected for the study in order to find out the prevalence of STH infections in the soils of these geographically different areas of Khurda, Angul and Rayagada (Figure 1).

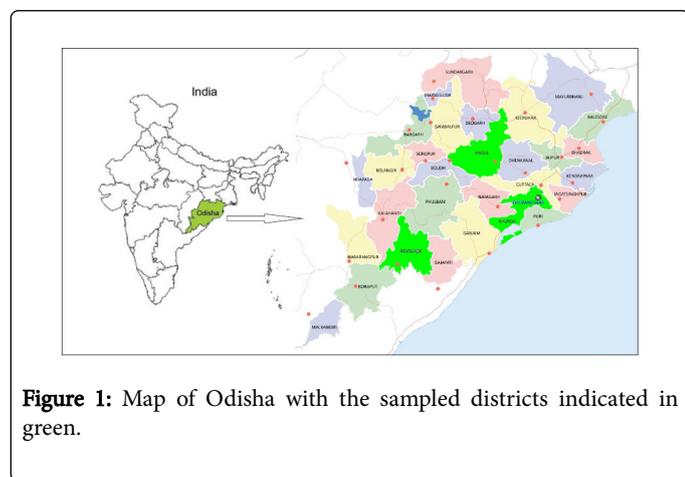


Figure 1: Map of Odisha with the sampled districts indicated in green.

| District | Schools Selected | Schools Covered | Target Students to test | Students Tested |
|-------------|------------------|-----------------|-------------------------|-----------------|
| Khurda | 8 | 6 | 100 | 130 |
| Angul | 6 | 5 | 100 | 104 |
| Rayagada | 5 | 5 | 100 | 110 |
| 3 districts | 19 | 16 | 300 | 344 |

Table 1: Participation of school girls in the test.

The direct wet smear was prepared by mixing a small amount of stool (about 2 mg) with a drop of 0.85% NaCl; this mixture was to

In the 2nd phase: 5-6 schools from tribal blocks (blocks with predominant tribal population) of the selected districts were sampled, subject to permission from the Headmasters (Principals) in consultation with the School Inspectors of the given blocks.

3rd Phase: 20-25 adolescent girls from the senior 3 classes (from sixth to eighth standard as their ages fell within 10-14 years of early adolescence) were selected to participate in the study after the informed consent of the guardians. The study was a part of the regular evaluation exercises conducted by the state government with the assistance of funding agencies whereof the parents/guardians of the selected children were taken into confidence regarding the essentiality and intention of the study and thereof the consent of the girls was taken primarily to support in offering the stool samples for routine microscopy as per the study guidelines.

Requisite authorization from the Directorate of Health and Family Welfare of the state and the Women and Child Welfare cell in the districts was obtained such that the results could be discussed with the state Planners and decisions taken thereof.

Final sample size

It was ensured that there is statistically significant representation of SC/ST and ashram schools in the area. Given a prevalence of 8% [11] at 95% CI and an absolute error of 10% the optimum sample size was coming out to be 310. In our study 344 girl students eventually consented to participate (Table 1).

A pretested predesigned questionnaire based checklist was administered to the selected girls to assess personal hygiene, hand washing habits and other relevant information. The opportunity was used to do a hemoglobin profile of the selected girls using Sahli's method and also impart them with health education regarding Personal hygiene, use of sanitary pads and their disposal, appropriate dietary habits, hand washing and besides others discourage the habit of open field defecation.

The selected girls were given a screw capped plastic sterile container bearing an inscription with name and age of child, to collect the early morning stool on the day of selection into the study and explained regarding stool collection which was to be at least 2 grams. The stool sample thus collected was subjected to routine microscopic evaluation by the team on the next day.

provide a uniform suspension under a 22- by 22-mm coverslip. This was the cost effective routine microscopy examination of stool

undertaken in the study in the community setting which was a limitation. Permanent smears of the stool in the lab which are more confirmatory could not be done for this study.

After 3 months of field work the data was collated and analyzed for any statistical significance, percentages and Chi-square test was used.

Results

The study was carried out in 3 districts of Odisha from three geologically different districts i.e. Khurda, Rayagada and Angul and carried out in 344 girls of classes 6-8th after their consent.

| Socio-demographic parameters | Frequency/no. | Percentages (%) |
|----------------------------------|---------------|-----------------|
| Religion | | |
| Hindu | 329 | 95.6 |
| Christian | 13 | 3.8 |
| Muslim | 2 | 0.6 |
| Caste | | |
| General | 83 | 24.1 |
| Other Backward Class (OBC) | 83 | 24.1 |
| Scheduled Class (SC) | 74 | 21.5 |
| Scheduled Tribes (ST) | 92 | 26.7 |
| Christian | 10 | 2.9 |
| Muslim | 2 | 0.6 |
| Family Type | | |
| Joint | 123 | 35.8 |
| Nuclear | 221 | 64.2 |
| Age of menarche | | |
| 10 | 15 | 4.4 |
| 11 | 63 | 18.3 |
| 12 | 118 | 34.3 |
| 13 | 130 | 37.8 |
| 14 | 18 | 5.2 |
| Source of Drinking Water at home | | |
| Borewell | 73 | 21.2 |
| River | 1 | 0.3 |
| Municipality Tap | 87 | 25.3 |
| Tubewell | 117 | 34 |
| Well | 66 | 19.2 |
| Type of House | | |
| Katcha | 22 | 6.4 |
| Pucca | 18 | 5.2 |
| Semi-katcha | 304 | 88.4 |
| Diet | | |
| Non-vegetarian | 331 | 96.2 |

| | | |
|----------------------------------|-----|------|
| Vegetarian | 13 | 3.8 |
| Intake of protein rich foods | | |
| 2-4 Times in a week | 226 | 65.7 |
| 4-6 Times in a week | 4 | 1.2 |
| Daily | 14 | 4.1 |
| Once in a week | 100 | 29.1 |
| Intake of green Leafy vegetables | | |
| Daily | 315 | 91.6 |
| Occasionally | 4 | 1.2 |
| Weekly | 20 | 5.8 |
| Never | 5 | 1.5 |

Table 2: Socio-demographic profile of the sampled girls.

Table 2 show that fathers of 28.5% of the respondents were farmers, 15.4% had small shops and 11.6% were daily laborers. Nearly 65% belonged to Other Backward Class and deprived classes. The living conditions and family composition was used as a proxy for the socio-economic condition of the families to which the selected girls belonged.

Nearly 88% lived in semipucca houses ; yet 96% were nonvegetarian in their diet, had proteins 2-4 times in week and daily intake of green

leafy vegetables was reported as nearly 92%. This could be because the girls were sampled from government schools and belonged to families whose main occupation was agriculture (owners/laborers). Nonvegetarian diet was predominantly fish which was freely available from the river and also it happened to be the staple diet of the population in all regions in costal, western or KBK region of Odisha.

| Worms | Frequency | % | Cumm f |
|-------------|-----------|------|--------|
| Ascariasis | 5 | 1.5 | - |
| Ancylostoma | 74 | 21.5 | - |
| Trichura | 22 | 6.4 | - |
| Stercoralis | 1 | 0.3 | 29.7 |
| No worms | 242 | 70.3 | |
| Total | 344 | 100 | |

Table 3: Prevalence of STH infections.

Table 3 indicates that the total STH load among girls in study was reported as 29.7% in this study. Maximum infection was reported as

ancylostoma i.e. hookworms and minimum was that of stercoralis which was less than 1% of the total.

| Worm | Khurda | Angul | Rayagada | Total |
|-------------|------------|------------|------------|-------|
| Ascariasis | 3 (60.0%) | 2 (40.0%) | | 5 |
| Hookworm | 36 (48.6%) | 16 (21.6%) | 22 (29.7%) | 74 |
| Trichuris | 9 (40.9%) | 8 (36.4%) | 5 (22.7%) | 22 |
| Stercoralis | | | 1 (100.0%) | 1 |

Table 4: Region wise prevalence.

In Table 4 Khurda registered highest prevalence of all worm infections among all the 3 districts which implies that perhaps the coastal zone has a greater predilection for worm infections.

| Parameters | Khurda | Angul | Rayagada | Total | Significance |
|------------------------------------------|---------|---------|----------|--------|--------------|
| Iron Folic Acid (last year) | | | | | |
| Yes | 35 | 1 | 64 | 100 | |
| | -26.90% | -1.00% | -58.20% | 29.10% | |
| No | 95 | 103 | 46 | 244 | 0 |
| | -73.10% | -99.00% | -41.80% | 70.90% | |
| Routine Deworming (last year) | | | | | |
| Yes | 5 | 1 | | 6 | |
| | -3.80% | -1% | | 1.70% | |
| No | 125 | 103 | 110 | 338 | 0.59 |
| | -96.20% | -99.00% | -100.00% | 98.30% | |
| Hand washing before food | | | | | |
| With soap and water | 73 | 26 | 59 | 158 | |
| | 56.20% | 25.00% | 53.60% | 45.90% | |
| With water | 57 | 78 | 51 | 186 | 0 |
| | 43.80% | 75.00% | 46.40% | 54.10% | |
| Hand washing after defecation | | | | | |
| With water | 2 | 3 | 10 | 15 | |
| | 1.50% | 2.90% | 9.10% | 4.40% | |
| With soil and water | 3 | 5 | 2 | 10 | |
| | 2.30% | 4.80% | 1.80% | 2.90% | |
| With ash and water | 1 | 1 | 7 | 29 | |
| | 0.80% | 1% | 24.6 | 8.40% | |
| With soap and water | 124 | 95 | 71 | 290 | 0 |
| | 95.40% | | 64.50% | 84.30% | |
| Body Mass Index (weight kg/height in cm) | | | | | |
| Normal | 53 | 34 | 55 | 142 | |
| | 40.80% | 32.70% | 50.00% | 41.30% | |
| Overweight | 5 | 2 | 3 | 10 | |
| | 3.80% | 1.90% | 2.70% | 2.90% | |
| Underweight | 72 | 68 | 52 | 192 | 0.099 |
| | 55.40% | 65.40% | 47.30% | 55.80% | |
| Anemia (hemoglobin estimate) [13] | | | | | |
| Mild (9.5-11 m/dl) | 102 | 69 | 71 | 242 | |

| | | | | | |
|-------------------|--------|--------|--------|--------|-------|
| | 78.50% | 66.30% | 64.50% | 70.30% | |
| Mod (9.5-8 mg/dl) | 28 | 35 | 39 | 102 | 0.032 |
| | 21.50% | 33.70% | 35.50% | 29.70% | |

Table 5: Region wise variations in determinants of worm infestation.

In Table 5 IFA has been given in Kurdha and Rayagada in 26.9% and 58.2% of the girls and this overall region wise difference is highly significant.

Routine deworming under School Health Programme was also largely absent as 98.3% of the girls reported of never having received an antihelminth tablet in last one year. However milder anemia cases were seen in Khurda. High rates of moderate anemia i.e. 33.7% vs. 21.5% cases were reported from Angul as compared to Khurda; the programmatic interventions like IFA and Albendazole distribution being almost absent in Angul district and this difference was mildly significant. Maximum underweight girls were also reported from Khurda. Interestingly hand washing habits i.e. before food and after defecation were best in Khurda also. This shows that though Khurda is better than other districts in terms of programmatic interventions and health education habits yet the incidence of worm infestation was reported highest in this district which could be attributing to the high anemia and under nutrition among the girls. Also the health education recap was necessary in this district as from data hookworm infection is reported more (21.4%) among girls who reported hand washing with soap and water after defecation. Other factors like food hygiene and storage are also to be looked into as these infections are soil borne and maybe transmitted by inadequately washed and cooked food also.

The survey brought out a grim picture of the school run governmental programmes and a high burden i.e. 29.7% of STH in girls in their early adolescence. This is an iceberg assessment of the disease burden as the boys and the girls not attending schools were not taken up in the study because of time and budget constraints. However it does manages to paint a rough picture of the existing lacunas in the School Health Programmes and that too district wise. At the end of the survey team conducted counseling sessions on the following:

- Hand washing habits before taking food and after defecation
- Insisted the school administration to get in contact with the governmental authorities in their respective blocks for timely and regular dissemination of the IFA (three monthly every year and Albendazole tablets (annually)
- The girls found with infections were appropriately treated with a broad spectrum antihelminthic

Conclusion and Discussion

This rapid assessment offers us a dipstick analysis of the prevalence of worm infections among school girls which was noted as 29.7% of which 21.5% of the worm infestation was attributed to hookworms. Hookworm and Trichuris infection was highest in Khurda district though the district wise distribution was not statistically significant. Iron Folic Acid intake was dismally low in the girls with the highest among the study districts being Rayagada with 58.2%. Deworming was practically negligible in all the sampled districts. Hand washing after defecation was best at Khurda. All the sampled girls were mild or moderately anemic and the worm infestation incidence was not

statistically significant. Hookworm incidence was more in those who were underweight. Worm incidence was higher in girls who said they washed hands with soap and water (questionable data or doubtful about appropriate method in use).

These study findings are better than those reported in Osazuwa et al. in Nigeria in 2010 where parasitic infection was reported at nearly 80% and hookworm being 75% [12]. In an Indian study done at Vellore in 2010 among school children in 6-14 years age STH prevalence was noted much less i.e. 7.8%, though hookworm rates were highest i.e. 8.4%. In that study residing in hut (katcha house) and open field defecation emerged as major risk factors for STH [12,13].

This indicates that the STH is a pending public health preventable problem which is mainly because of food and hygiene habits. School children should be made conscious of these and appropriate health programmes like IFA and deworming should be rightly and stringently implemented with regular monitoring to address the problem of not just STH but associated problems of anemia and underweight.

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