

A Study of the Incidence of Nematode Infections in School Going Children in Indore, Madhya Pradesh, India

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Abstract—Background: Intestinal nematode infections, particularly soil transmitted helminths (STHs) are a major public health concern in developing countries. School aged children are especially vulnerable due to poor sanitation, environmental exposure, and inadequate hygiene practices. These infections can lead to malnutrition, anaemia, impaired physical development, and poor academic performance.

Objective: To determine the incidence and distribution of intestinal nematode infections among school children in Indore, Madhya Pradesh, and to analyze the associated demographic and hygiene related risk factors.

Methods: A cross-sectional study was conducted among 350 school going children aged 5 – 14 years from government and private schools in Indore over a period of six months. Stool samples were collected and examined, using macroscopic examination, direct saline and iodine wet mounts, and formalin ether concentration techniques. Data regarding demographic characteristics and hygiene practices were collected using a structured questionnaire. Statistical analysis was performed using descriptive statistics and Chi-square tests.

Results: Out of 350 samples, 94 (26.8%) were positive for nematode infections. *Ascaris lumbricoides* was the most prevalent parasite (15.1%), followed by Hookworm (6.3%), *Enterobius vermicularis* (3.1%) and *Trichuris trichura* (2.3%). Higher infection rates were observed in children aged 6 - 10 years (31.7%). Risk factors significantly associated with infection included poor hand hygiene, walking barefoot and lack of sanitary toilet facilities.

Conclusions: Intestinal nematode infections remain prevalent among school children in Indore. Implementation of regular deworming programs, improved sanitation, and health education initiatives are essential for effective control.

I. INTRODUCTION

Intestinal parasitic infections continue to represent a major public health challenge worldwide particularly in developing countries where sanitation and hygiene conditions are often inadequate. Among these infections, soil transmitted helminths (STHs) constitute the most common parasitic infections affecting humans. The most important nematodes infecting humans include *Ascaris lumbricoides*, *Trichuris trichura*, hookworms (*Ancylostoma duodenale* and *Necator americanus*) and *Enterobius vermicularis*.

According to global health estimates, over one billion people are infected with soil transmitted helminths, with the highest burden occurring among school-aged children. These infections are commonly transmitted through contaminated soil, food, or water, particularly in areas where sanitation infrastructure is inadequate. Children are at greater risk due to frequent contact with contaminated soil during outdoor play and poor hygiene practices such as inadequate handwashing.

The clinical consequences of intestinal nematode infections include abdominal discomfort, diarrhoea, malnutrition, anaemia, and impaired cognitive development. Chronic infections may result in growth retardation and reduced school performance, thereby affecting overall child health and development.

In India, the prevalence of soil transmitted helminths varies widely depending on geographical location, environment factors, and socio-economic conditions. Studies conducted in various parts of the country have reported prevalence rates ranging from 20% to over 60% among school-aged children. Urban areas with dense population and inadequate sanitation are particularly vulnerable to these infections.

Indore, located in the central state of Madhya Pradesh, is a rapidly developing urban centre with a diverse population. Despite improvements in urban infrastructure certain areas still face challenges related to sanitation, waste disposal, and access to safe drinking water. School going children living in such environment are at increased risk of acquiring intestinal parasitic infections.

Regular surveillance studies are essential to understand the epidemiology of these infections and to guide public health interventions such as deworming programs, sanitation improvements, and public education initiatives.

The present study was therefore conducted with the following objectives:

- 1) To determine the incidence of nematode infections among school-going children in Indore.
- 2) To identify the common species of intestinal nematodes infecting these children.
- 3) To analyze the association between infection and demographic or hygiene related risk factors.

II. Material and Methods

Study design

A cross-sectional observational study was conducted over a period of six months (January to June 2025).

Study Area

The study was conducted in Indore city, Madhya Pradesh, India, involving selected government and private schools located in urban and peri-urban areas.

Study Population

The study population consisted of school going children aged 5 – 14 years

Sample Size

A total of 350 children were included in the study.

Sampling Method

Schools were selected using simple random sampling, and children were selected with the help of school authorities.

Inclusion Criteria

Children aged 5 – 14 years

Children attending selected schools

Children whose parents or guardians provided informed consent

Exclusion Criteria

Children who had received anti-helminthic treatment within the past three months.

Children who did not provide stool samples.

Ethical Considerations

Approval was obtained from the Institutional Ethics Committee.

Written informed consent was obtained from parents or guardians.

Confidentiality of participant data was maintained.

Data Collection

Information was collected using a structured questionnaire covering:

Age

Gender

Type of school

Handwashing habits

Use of footwear

Drinking water source

Sanitation facilities

Previous deworming history

Sample Collection

Each child was provided with a sterile labeled stool container along with instructions for sample collection.

Stool samples were collected in the morning.

Samples were transported to the microbiology laboratory within 2 hours.

Laboratory Examination

Macroscopic Examination

Stool samples were examined for:

Colour

Consistency

Presence of mucus

Presence of blood

Visible parasites

Microscopic Examination

Direct saline wet mount

A small portion of the stool was mixed with normal saline and examined under 10x and 40x magnification.

Iodine wet mount

A small amount of stool was mixed with Lugols iodine to enhance visualization of parasitic structures and examined under 10x and 40x magnification.

Formalin Ether Concentration Technique

This technique was used to increase detection sensitivity.

Procedure:

- Stool was emulsified in 10% formalin
- Filtered through gauze
- Ether added
- Centrifuged at 3000 rpm for 5 minutes
- Sediment examined microscopically.

Identification of Parasites

Identification of nematode eggs was based on morphological characteristics.

Table 1 Morphological Characteristics of Nematode eggs.

Parasite	Morphological features
Ascaris lumbricoides	Thick shell with mammilated outer layer
Hookworm	Oval thin shelled egg with segmented ovum
Trichuris trichura	Barrel shaped eggs with bipolar Plugs
Enterobious vermicularis	Planoconvex egg with flattened sides

Statistical Analysis

- Data were analysed using statistical software.
- Prevalence expressed as percentage
- Chi-square test used for association
- P value < 0.05 considered statistically significant

Results

Overall Prevalence

Table 2: Overall prevalence of Nematode infection

Total Samples	Positive	Negative	Prevalence
350	94	256	26.8%

Species Distribution

Table 3 : Distribution of Nematode Species

Parasite	Number	Percentage
Ascaris lumbricoides	53	15.1%
Hookworm	22	6.3%
Enterobious vermicularis	11	3.1%
Trichuris trichura	8	2.3%
Total	94	26.8%

Age Distribution

Table 4: Age-wise distribution Here it is in a clean table format:

Age Group	Examined	Positive	Prevalence
5-7 years	110	30	27.3%
8-10 years	120	38	31.7%
11-14 years	120	26	21.7%

Highest infection rate was observed in 8 – 10 years group

Gender Distribution

Table 5: Gender distribution

Gender	Examined	Positive	Prevalence
Male	190	52	27.4%
Female	160	42	26.2%

School Type

Table 6: Infection by School Type

School Type	Examined	Positive	Prevalence
Government	210	67	31.9%
Private	140	27	19.3%

Hygiene Factors

Table 7: Association with Handwashing

Handwashing Practice	Positive	Negative
Regular	28	142
Irregular	66	114

Footwear Usage

Footwear Habit	Positive	Negative
Always wear footwear	36	162
Often barefoot	58	94

Table 9: Sanitation Facility

Toilet Facility	Positive	Negative
Sanitary toilet	40	168
Open defecation	54	88

Source of Drinking Water

Water Source	Positive	Negative
Treated water	32	150
Untreated water	62	106

III. DISCUSSION

The present study demonstrated an overall prevalence of 26.8% intestinal nematode infections among school children in Indore.

This finding is comparable with studies conducted in other regions of India, where prevalence rates between 20% and 40% have been reported.

The most common parasite identified was *Ascaris lumbricoides* accounting for 15.1% of infections. This observation is consistent with previous epidemiological studies indicating that *Ascaris* remains the predominant soil transmitted helminth in many parts of India.

Hookworm infections were the second most common infection in the present study. These infections are associated with walking barefoot and contact with contaminated soil.

Children who frequently walked barefoot showed a significantly higher prevalence of infection.

The highest infection rate was observed among children aged 8-10 years, possibly due to increased outdoor activity and greater exposure to contaminated environments.

Government school children showed a higher prevalence compared to private school children, likely reflecting differences in socioeconomic conditions, sanitation facilities and health awareness.

Poor hygiene practices, including irregular handwashing and open defecation were strongly associated with infection in the present study.

The findings highlight the importance of improving sanitation infrastructure and promoting hygiene education among school children.

IV. CONCLUSION

The present study demonstrates that intestinal nematode infections remain a significant health problem among school going children in Indore, with an overall prevalence of 26.8%.

The most common parasite identified was *Ascaris lumbricoides*, followed by hookworm infections.

Improving hygiene practices, sanitation facilities, and implementing regular deworming programs are essential to reduce the burden of infection.

V. RECOMMENDATIONS

- 1) Periodic school based deworming programs.
- 2) Health education on hand hygiene and sanitation.
- 3) Provision of safe drinking water in schools.
- 4) Improvement of toilet facilities.
- 5) Regular screening for intestinal parasites.

REFERENCES

- [1] World Health Organisation. Soil transmitted helminth infections.
- [2] Pullan RL, et al. Global epidemiology of soil transmitted helminths.
- [3] Indian Journal of Medical Research. Epidemiology of intestinal helminths in India.
- [4] Centers of Disease Control and Prevention. Parasites and helminth infections.
- [5] Ministry of Health and Family welfare, India. National Deworming Day Program.