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Research Article

# Distribution of Intestinal Parasitic Infestations in Various Rural and Urban Communities of Puducherry and Comparison of its Associated Risk Factors

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## Abstract

Parasitic infections are a major public health problem. Approximately 75% of world's population is suffering from it. Unlike developing countries, India ranks among those countries in the world with high intestinal parasitic infection with common agents belonging to the 2 broad categories of protozoa and helminths. The present study was conducted to estimate the distribution of various intestinal parasitic infestations among selected urban and rural areas of Puducherry, India. The participants were enrolled consecutively after taking consent and stool samples were collected from them after a detailed history and microscopy was done on both direct and concentrated samples. Of the total 300 patients enrolled, 150 each were taken from the rural and urban areas. It was seen that 51% were females compared to 49% which were male participants. Among the total positive cases, it was found that 9.3% were positive from rural and 6% were positive from urban areas. Among all the participants, 2% were positive for *Blastocystis*, 3% positive for *Entamoeba* spp and 1% was positive for *Giardia* cyst. One participant was found to have a co-infection of *Entamoeba* spp and *Blastocystis*. Also, 26% opted for open defecation 35% carried out their work on bare - foot which are significant findings. Domestic animals like dogs, cows etc were seen in 6% of the households as they have bearing on the zoonotic transmission of parasites.

**Keywords:** Microscopy; Formol Ether Concentration; Soil Transmitted Helminths; Adults; Ascaris; Isolation

## Introduction

Parasitic infections are a major public health problem and approximately 75% of world's population is suffering from it. Unlike developing countries, India ranks among those countries in the world with high intestinal parasitic infection [1]. The common agents causing intestinal parasitic infestations belong to the 2 broad categories of protozoa and helminths. These infections are most prevalent among the below poverty line people which contributes the incidence of instability in economy that can persists from generation to generation [2]. According to WHO, the incidence of intestinal infections are more prevalent in low income population groups due to unsanitary living condition [3]. Various parasitic infections like amoebiasis, *Giardia* sis, ascariasis, Trichuriasis are responsible for high level of morbidity and mortality, anemia, seizures, portal hypertension etc [1]. Due to various parasitic infections, approximately 10,500 deaths each year are due to complications of ascariasis, 6500 deaths per year due to anemia caused by hookworm infections [4]. Mostly, asymptomatic individuals for parasitic infections are considered to be the most dangerous people to the society because they transmit infection without giving due importance to it and forms a silent reservoir in the community [5].

Intestinal parasites cause serious public health problems in India. They are more prevalent in the poor segments of the population with low household income, overcrowding and limited access to clean water, which are more vulnerable to infections. As there is no proper immunization and vaccines available to fight against parasitic infection, it is considered as the major drawback and still falls under the neglected tropical diseases [6]. Insufficient parasitic disease research, neglect of the problem in developing countries and a lack of follow - up treatment are some of the barriers for not allowing the parasitic infection rate to decrease [7]. Also, among low socio - economic people, there is insufficiency of epidemiological data on the diffusion and prevalence of intestinal parasites [8]. Mostly people acquire parasitic infection because of poor hygiene like contaminated food and water [1]. To know the prevalence of different intestinal parasitic infestations among

pediatrics and adult age groups in our region, it is important to know the exact burden of intestinal parasitic infection in the various communities of Puducherry which hasn't been conducted to the best of our knowledge. Therefore it is necessary to have baseline information regarding parasitic infections and the present study is purposed to do it. Many of the currently available studies were done in children, mostly school going children or in under 5 years of age. There are not many studies done in adults or in the whole pediatric population. A whole study will give us a better idea regarding the vulnerable group(s) in the various categories of age and will also be helpful in detecting the various intestinal parasites commonly seen in the various age groups.

Various factors can influence the level of intestinal parasitic infestations and this also varies in different regions of the world [9]. This will guide us in implementing the various treatment, preventive and control measures based upon the commonly prevalence intestinal parasites. The outcome of the study will also help in introducing and triage of various diagnostic modalities for the various intestinal parasitic infections so that resources can be maximally and optimally utilized for the benefit of the population of the area.

## Materials and Methods

This cross sectional prospective study was done in Puducherry for a period of 4 months (May – August) in 2018. Any stool samples of adult/ pediatrics participant in the community with or without diarrhea and who are willing to participate were enrolled during this period. The entire freshly collected stool from the community were taken to the Parasitology laboratory of the Microbiology Department and processed within two hours. The workflow of the processing is shown in figure 1.

**Figure 1:** Flowchart of the stool sample processing.

### Sampling size calculation

Assuming expected prevalence of intestinal parasite infection in the community as 39%, alpha error of 5% (95% confidence level) and relative precision of 20%, we need 143 individuals for the study [10]. Since we need prevalence estimates for urban and rural separately, we had recruited 150 individuals in urban and 150 individuals from the rural area (a total of 300 individuals). The sample size was calculated using Open Epi software version 3.1.

### Sampling technique

There are four villages under our institute rural health center and four blocks under the urban health center. One of the villages and one of the blocks were randomly selected for the study. Within the village and block, proportionate stratified random sampling (stratification is based on age group pediatric and adult) was used to select the required number of individuals for the study. For the purpose of sampling, census information maintained at the rural and urban centers were also used.

### Statistical test to be used for data analysis

Data was entered in Epi Data entry software (version 3.1). Analysis was done in Epi Data analysis software (version 2.2.2.186). Prevalence of intestinal parasite infection in urban and rural areas was reported separately with 95% confidence intervals. Association of age, gender, education, residence (urban/rural), presence of toilet at home and open defection with intestinal parasite infection was assessed using chi square test. A P value of less than 0.05 was considered as statistically significant.

### Ethical considerations

Informed consent was taken from adult participant and written informed consent and assent was taken from pediatrics patients and only those who are interested after the study has been properly explained to them were enrolled in the study and the stool samples were collected only from these participants.

## Results

### Demographic findings

In the current study, a total of 150 stool samples were enrolled from urban and 150 stool samples from the rural area after taking detailed history of the participants for a period of 2 and half months (June – August, 2018). It was seen that the mean age of the study population was 19 years with standard deviation of 17. Analysis of various age groups showed that the majority of the participants belong to the 6 - 15 years age group (41%, $p < 0.05$) followed by 0 - 5 years of age group and the least in patients above 60 years of age (2%). It was seen that majority of the study population were school going children (53%) followed by other occupation like agriculture, manual labour etc (Table 1).

Of the total participants enrolled for the study, 51% (152/300) were females compared to 49% (148/300) which were male participants. So, nearly equal number of participants of either gender was enrolled. The household sanitary conditions among the study population showed that 74% (223/300) had closed toilet at their home, whereas the remaining 26% (78/300) opted for open defecation which is still a significant finding. The role of shoes or foot covering has got a big role in the transmission of various intestinal helminths especially soil transmitted helminths.

| Demographic characters | Frequency | Percentage (%) |
|---|---|---|
| Age group | | |
| 0-5 | 57 | 18.94 |
| 6-15 | 122 | 40.53 |
| 16-30 | 52 | 17.28 |
| 31-45 | 43 | 14.29 |
| 46-60 | 19 | 6.33 |
| >60 | 7 | 2.33 |
| Gender | | |
| Male | 148 | 49.17 |
| Female | 152 | 50.66 |
| Occupation | | |
| Employee | 2 | 0.85 |
| Agriculture | 2 | 0.85 |
| Coolie | 3 | 1.27 |
| Driver | 1 | 0.42 |
| Farmer | 2 | 0.85 |
| Granite work | 1 | 0.42 |
| PWD employee | 1 | 0.42 |
| Shopkeeper | 2 | 0.85 |
| Teacher | 1 | 0.42 |
| Watchman | 1 | 0.42 |
| Worker | 4 | 1.69 |
| Sanitary condition | | |
| Toilet at home | 221 | 73.66 |
| Open defecation | 78 | 25.91 |
| Shoes | | |
| Walking with slippers | 195 | 65.12 |
| Barefooted | 105 | 34.88 |
| Pets | | |
| Cat | 1 | 0.36 |
| Cat and dog | 5 | 1.80 |
| Cow | 5 | 1.80 |
| Cow and dog | 2 | 0.72 |
| Cow and hens | 6 | 2.16 |
| Dog | 17 | 6.12 |
| Dog and cow | 1 | 0.36 |
| Dog and hens | 1 | 0.36 |
| Hen | 6 | 2.16 |
| Hen and cows | 3 | 1.08 |

**Table 1:** Demographic distribution of the study population.

It was observed that 65% (195/300) of the enrolled patients gave a history of wearing shoes while doing their outdoor work whereas remaining 35% (105/300) carried out their work on bare - foot (Table 1).

It was also seen that among the various domestic animals kept in their homes which may have a bearing of zoonotic parasitic transmission; dogs were kept as pets in 6% (p value = 0.21) of the household followed by other pets like cats, cows and hens. (Table 1). However, the enrolled participants didn't give any history of keeping pigs or goats in their homes and said that they are done on a commercial scale as piggeries or farms separately. Most of the enrolled participants from the rural areas were farmers dealing with cultivation or labors and not into animal farming.

## Clinical features

Majority of the participants were apparently healthy with no major complaints. Among the enrolled participants, only two participants from the rural area gave complaint of diarrhea whereas the other participants were passing formed stool. It was also found that no enrolled participants had a complaint of blood in the stool and very few (4) had complaints of abdominal pain. Other complaints like cold fever, body pain, and chest pain were given by few participants (Table 2).

| Comparison Between Rural and Urban | | |
|---|---|---|
| Number Percentage (%) | | |
| Rural | 14 | 9.33 |
| Urban | 9 | 5.96 |
| Distribution of Age Group | | |
| Number Percentage (%) | | |
| 0-5 | 4 | 7.02 |
| 6-15 | 5 | 4.10 |
| 16-30 | 5 | 9.62 |
| 31-45 | 6 | 13.95 |
| 46-60 | 2 | 10.00 |
| >60 | 1 | 14.29 |
| Comparison Between Male and Female | | |
| Number Percentage (%) | | |
| Male | 9 | 6.08 |
| Female | 14 | 9.15 |
| Comparison Based on Defecation | | |
| Number Percentage (%) | | |
| Toilets at home | 18 | 8.07 |
| Open defecation | 5 | 6.41 |
| Comparison Based on Walking | | |
| Number Percentage (%) | | |
| Walking on slippers | 15/196 | 7.65 |
| Barefooted | 8/105 | 7.62 |

**Table 2:** Comparison of the various factors with that intestinal parasites recovery among the positive cases.

## Parasitic distribution

Among all the enrolled participants 2% were positive for *Blastocystis* (7/300, 2.3%), 3% positive for *Entamoeba* spp (9/300) and 2% was positive for *Giardia* cyst (6/300, 2%). One participant from the rural area was found to have a co - infection of *Entamoeba* spp and *Blastocystis* Under laboratory investigations, direct and concentrated techniques were done and it was found that there were seven positive samples for *Blastocystis*, nine for *Entamoeba spp*, one for both *Entamoeba* spp and *Blastocystis*, and three for *Giardia* cysts from direct methods by using different stains like iodine, saline, trichrome stains and the similar number of positive cases were detected in concentration method (Figures 2 and 3).

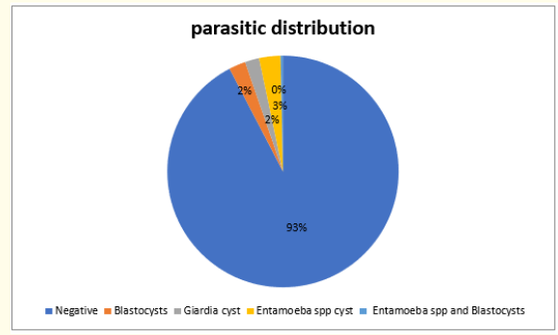


**Figure 2:** Different parasite distribution among the study population.

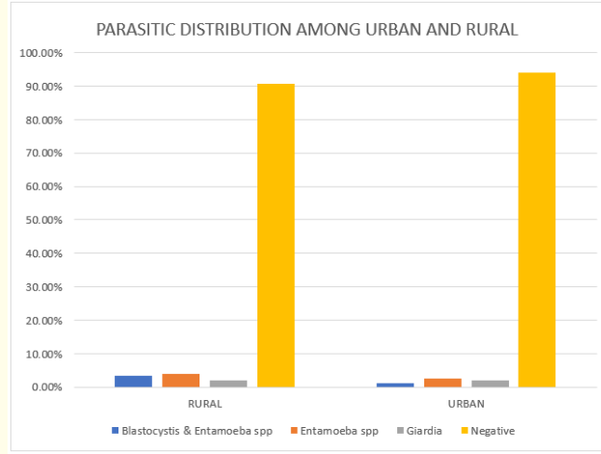


**Figure 3:** Difference in the parasite distribution in the rural and urban areas.

Among the total positive cases (N = 23), it was found that 9.3% were positive from rural areas (14/150) and 6% were positive from urban (9/150), whereas the remaining were found to be negative. Among the rural positive cases, 35% were positive for *Blastocystis* (5/14), 42.8% positive for *Entamoeba spp* (6/14) and 21.4% for

*Giardia* spp (3/14) and among the urban positive cases 22.2% positive for *Blastocystis* (2/9), 44.4% for *Entamoeba* spp (4/9) and 33.3% for *Giardia* spp (3/9).

In the different age groups of the participants, 7% were found positive for 0 - 5 year's age group which is the least and 14% were found positive for 31 - 45 years age group (Table). The distribution of gender among the positive cases showed that 9% were positive in females whereas only 6% were positive in males. Presence of toilet at home or open defecation greatly influences the parasitic infection. It was found that among the positive cases 78.2% of the participants have toilets at their home (18/23) and 21.7% of the positive participants have opted for open defecation (5/23). Among those participants whose stool sample were positive for one or more intestinal parasites, 15 of them were doing their outdoor work with slippers in contrast to 8 of them who carried out their work bare-footed. (Table 2) The participants from the urban areas mostly have tap water for drinking purpose and those in the rural areas have wells or hand pumps as their drinking water sources. However, they use pond water also for cleaning and washing purposes and also for their recreation. They either filter their water using water filters or boiling in rural areas though most homes in urban areas use home reverse osmosis or water filters for their drinking water purification.

## Discussion

This study demonstrates the prevalence of intestinal parasitic infection in both rural (Ramanathapuram) and urban (Kurchikuppam) communities of Puducherry. In this study, it was observed that the prevalence of intestinal parasitic infection may be associated with sanitary conditions, whether participants are walking with slippers or bare-footed, pets at their home, and other clinical features.

The overall prevalence of parasitic infection of this study is 7.6%, which was found to be lower than the prevalence found in other similar studies. The prevalence of the study done in the communities of southern Thailand was 13.9% [11]. The variation in the prevalence rate may be due to the differences in the study population, sample size, occupation and participants with better knowledge of health and hygiene.

The distribution of gender among the study population shows that the female (153/300,51%) predominates over male ( 148/300,49%), whereas the study done in Brazil on intestinal parasitic infection in community showed that male predominates females, being 54.8% in males and 45.2% in females [12]. The study which is done in Malaysia also showed that females predominates over male, the prevalence rate for males and females was given as 41.7% and 54.7% respectively [13]. The species found in the study were *E. coli, Giardia* spp, Blastocysts, with a percentage of 3%, 2% and 2.33% respectively and a participant with both *Entamoeba spp* and *Blastocystis* (0.33%). The study done in the communities of southern Thailand showed that the prevalence of *Blastocystis* and *Giardia* spp as 4.0% [11].

The study done in Malaysia on determining the prevalence of intestinal parasites in communities showed that prevalence of *Giardia* and *E. coli* as 5.2% which was comparatively higher than this study [13].

The prevalence rate of this study in the rural area was found to be 9.3%, which was higher than that in the urban which was 6%. This may be due to the proper sanitation facilities, better knowledge about personal health and hygiene among the urban participants. Among the distribution of various age groups, the parasitic infection was highest in 31 - 45 years age group (6%) followed by (6 - 15 yrs. age) showing 5% and the least was found in the age group of > 60 as only1%.

This study reveals that 74% of the household members have toilets at their home out of which 8.07% were positive for the intestinal parasitic infection and 26% of the participants opted for open defecation, out of which 6.41% were positive for intestinal parasitic infection. This is due to lack of knowledge about personal health and hygiene. The study done in Taboo, on effects of hygiene and defecation behavior showed that 98.5% of the most household members required latrine as they are practicing for open defecation leading to a high prevalence rate [14]. Their findings were quite high compared to our study.

Another important demographic characteristic is the factor of whether participant is walking with slippers or bare footed, as it plays an important role in the transmission of various helminths. This study reveals that 65.12% (196/301) of the participants are walking with slippers, out of which 7.65% were found positive for parasitic infection and 34.9% (105/301) are walking bare-footed, out of which 7.62% were found positive for intestinal parasitic infection. The study done in Taboo, on effects of hygiene and defecation behavior showed that only 4.3% of the participants wearing shoes while walking and others were walking bare-footed which lead to relatively high prevalence rate of helminth species [14].

Among the total positive cases, it was found that 9.3% were positive from rural (14/23) and 6% were positive from urban (9/23), whereas the remaining were found to be negative. Among the rural positive cases, 3.3% were positive for *Blastocystis* (5/14), 4% positive for *Entamoeba spp* (6/14) and 2% for *Giardia* spp (3/14) and among the urban positive cases, 1.3% positive for *Blastocystis* (2/9), 2% for *E. coli* (4/9) and 2% for *Giardia* spp (3/9). This reveals that the intestinal infestation rate is higher in the rural areas comparatively to the urban area. The study done in Lucknow, India on the prevalence of intestinal parasites in rural and urban also showed that intestinal infestation rate was higher in rural population. The rate was 5.4% and 20.8% in the urban and rural areas respectively which was similar to what was seen in our study [15]. Various parasite species were found in both the direct and concentrated methods which were done using different stains like iodine, saline and trichrome stain.

One possible limitation which we have observed in this study is that most of the parasites recovered were protozoan parasites and less of intestinal helminths. This may be due to a round of mass de -worming which was done in most of the areas of Pondicherry including the study sites. This was found on further feedback from the enrolled participants on further asking after the results were analysed and very less of intestinal helminth infestations were observed.

### Benefits of the study

This baseline study gives us an idea about the distribution of various intestinal parasites in the various age groups in the communities of Puducherry and can guide us in implementing the various treatment, preventive and control measures based upon the commonly prevalence intestinal parasites in communities. The outcome of the study will also help in introducing and triage of various diagnostic modalities for the various intestinal parasitic infections so that resources can be maximally and optimally utilized for the benefit of the population of the area. This has paved way for a larger study involving more areas in and around Puducherry is underway to see the overall picture as the current study has its own drawback of its sampling timings.

## Conclusion

Intestinal parasites cause serious public health problems world wide. These parasitic infections are mostly acquired because of poor hygiene like contaminated food and water. This study showed that intestinal parasitic infections still are prevalent in the various areas included in the study and various factors like open defecation, walking bare footed influences it transmission and must be looked into in detail. *Blastocystis* was the maximally recovered intestinal parasite in the current study while the *Giardia* spp were less prevalent. Also, maximum infestation was seen in the economically productive age group who goes out of their home for work. This baseline data can help us to work out the areas where the infection rate is more to combat this problem.

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