HOSPITAL BASED SURVEILLANCE OF ENTERIC PARASITES AND COMPARATIVE ANALYSIS OF INTESTINAL PARASITIC INFECTIONS IN THE HOSPITAL CHILDREN WITH RURAL SCHOOL CHILDREN AT KANCHEEPURAM

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ABSTRACT: BACKGROUND: Intestinal parasitic infections (IPIs) are prevalent in developing countries like India and have been the important cause of morbidity and mortality especially in children. **OBJECTIVES:** Estimate prevalence of various intestinal parasitic infections in hospital as well as in rural school children to obtain an accurate understanding of the burden and cause of intestinal parasitic infections in Kancheepuram. **MATERIALS AND METHODS:** A total of 2654 stool samples were collected, processed, and microscopically examined for intestinal parasites. 2267 were adults and remaining 387 were children. In addition, 314 rural school children were also included in the study. **RESULTS:** The overall prevalence of IPIs was estimated as 32.59% (739/2267) in hospital adults and 55.50% (215/387) in hospital children and 56.68% (178/314) in rural school children; high prevalence rate was found among hospital children and in school children when compared to adults. Among the protozoans E. histolytica was the highest, followed by Giardia and among the helminths hookworm was highest followed by Ascaris lumbricoides, Enterobius vermicularis, Hymenolepis nana and Strongoloides larvae respectively. **CONCLUSIONS:** Intestinal parasitic infections spreads due to low standards of personal hygiene, poor sanitation, open air defecation and an illiterate population, thus suggesting need for regular surveys to minimize the IPIs rate in the community.
KEY WORDS: Intestinal parasitic infections, rural children, stool microscopy

INTRODUCTION: Intestinal parasitic Infections (IPIs) are major health problem in many parts of the world; especially in the under developed and developing countries. Estimation of global magnitude of morbidity and mortality due to IPIs are of major concern. It is estimated that

about 3.5 billion people are globally infected, out of which 300 million are symptomatic, 50% being children below 12 years[1]. Open air defecation, poor sanitation, scarcity of portable water and low standards of personal hygiene are few of the factors that contribute to rapid spread of these infections[2]. Helminths and protozoa are transmitted among people by both direct and indirect methods [3]. Helminthic infections are the main cause of loss of appetite, iron deficiency anemia, gastrointestinal symptoms, perianal pruritis, gastrointestinal or biliary obstruction, malnutrition in children leading to impairments in physical and intellectual functions [4,5,6]. A prevalence survey of IPIs is a pre- requisite for the development and implementation of control strategies. Considering this, the present study was undertaken among the hospital patients including both adults and children in Meenakshi Medical College Hospital & Research Institute (MMCH & RI), which is located in rural Kancheepuram; to compare the prevalence rates of IPIs between the hospital children with that of rural school children and also to know the intensities of parasitic infection in adults.

MATERIALS AND METHODS:

Study design

- Study was carried out for two years from January 2011 to December 2012. Both hospital patients (adults and children) and rural school children from Kancheepuram were included in the study. All the stool samples were tested in the diagnostic laboratory of Microbiology department at MMCH and RI.
- Hospitalized patients were selected based on the clinical features of enteric parasitic infections, such as diarrhoea, dysentery, abdominal discomfort etc.
- School children were selected randomly based on history of decreased appetite, malnourished with inadequate weight according to the age.

Study population and Sample size: The study population consisted of patients who included both adults and children from MMCH and RI. The total of 2654 patients were included in the study; 2267 were adults and remaining 387 were children. In addition, 314 rural school children were also included in the study.

Stool sample collection and Laboratory testing: For each enrolled patient for study at hospital (both children and adults) and child from rural Kancheepuram school, a standard stool examination (saline mount and iodine mount) for intestinal parasites was done along with stool concentration techniques[7]. The test was conducted at the diagnostic microbiology laboratory at MMCH and RI. At the time of enrollment, hospital patients and school children were given a clean, dry leak proof container labeled with name, age, sex and identification number for the collection of stool sample. The school children were provided with written guidelines for collecting the stool sample; also informed to their caretaker and it was explained orally to the hospital patients.

In the laboratory, macroscopic examination of stool samples were done to look for consistency, presence of blood, mucous, adult intestinal worms, segments of worms of Taenia species. Clean glass slides were used for wet mount preparations in saline and Lugol's iodine and were microscopically examined under low and high power bright field[8]. Finally the stool samples were concentrated by Formol–ether sedimentation technique [9]. Again iodine stained mounts were prepared and examined microscopically, stool examination was done within one hour of collecting the stool for hospital patients. We collected 20 stool samples each day from

school children and ensured that sample reached the lab within 2 to 3 hours and then examined immediately. We made sure that the stool samples from school children were not overlapping with hospital children.

Ethical conservations and consent: The protocol for the study was approved from the institutional ethical committee. Approval was obtained from the headmaster of the school and informed consent was obtained from each of the participants (pupil)'s parents or guardians. Infected pupil was informed to the primary health care centre of MMCH and RI for further follow-up and to provide free treatment. The approval was on the agreement that the patient's findings will be kept confidential and it is used for research purpose only.

RESULTS:

Prevalence of intestinal parasitic infection: The overall prevalence of IPIs was estimated as 32.59% (739/2267) in hospital adults and 55.50% (215/387) in hospital children (table – 2) and 56.68% (178/314) in rural school children (table – 5); high prevalence rate was found among hospital children and in school children when compared to adults.

Intensity of infection: Protozoal infection rate was high in hospital patients including children and the same findings were observed even in school children. Protozoal infection rate was 23.24% (527/2267) in hospital adults, 45.73% (177/387) in hospital children (table – 3) and 46.5% (146/314) in school children (table-6).

Helminthic infection rate was low in hospital patients as well as in school children. Helminthic infection rate was 9.35% (212/2267) in hospital children, 9.8% (38/387) in hospital children (table – 4) and 10.19% (32/314) in school children (table – 7)

Among the protozoans E. histolytica was the highest, followed by Giardia, in hospital and school children groups taken for the study. Among the helminths hookworm was highest followed by Ascaris lumbricoides, Enterobius vermicularis, Hymenolepis nana and Strongoloides larvae respectively.

Intestinal Parasitic distribution in stool specimen among adult males and females in hospital, in hospital children and in school children at Kancheepuram is given in tables 8, 9 & 10. Dual or polyparasitism was not observed in our study.

DISCUSSION: The prevalence rates of intestinal parasitic infections and type of parasite exhibit wide variation from country to country, between geographical areas and even seasonal variations also occurs [10]. In the era of easily available antiprotozoal and antihelminthic drugs, IPIs expected to decline; however many studies including our study showed high prevalence of IPIs [11- 14]. Our study revealed high prevalence rate of protozoal parasitic infection in all the groups when compared to the prevalence of helminthic parasitic infection. The decline in helminthic prevalence rate may be attributed to regular supply of deworming agents to the children in rural Govt. schools by the Govt. of Tamilnadu. We have observed in our study that community people drink water from the bore well, that can be another reason for decreased prevalence rate among helminthic infections[15].

The prevalence of IPIs was estimated to be 32.59% in hospital adults, 55.50% in hospital children and 56.68% in rural school children. Parasitic infection rate is high both in hospital patients group as well in rural school children. Similar prevalence rate is reported in other Indian studies in the year 2000 at Chandigarh (46.8%), in 2002 at Delhi (47%) and in 2011

(51.1%) at Chitradurga [7,13]. However our results are considerably higher than that of some other earlier studies [3,16].

In our study IPIs namely E.histolytica/dispar/moshkovskii, Giardia lamblia, hookworm, Ascaris lumbricoides, Enterobius vermicularis, Hymenolepis nana and Strongyloides stercoralis were identified in decreasing order from stool samples. Most common intestinal parasite observed was cysts of E.histolytica/dispar/moshkovskii, 33.59% in hospital children and 33.9% in rural school children. Prakash et al has reported almost same rate 35.6% and 20.3% by Dakshina Bisht et al [17,18]. However, there is one limitation for stool microscopic diagnosis, as microscopic morphology of cyst of E.histolytica is similar to other non-pathogenic species like E. dispar or E.moshkovskii. WHO recommended the use of the term E.histolytica/dispar/moshkovskii for reporting all diagnosis of amoebiasis [19]. Amoebiasis is commonly transmitted by consumption of food and water contaminated with E.histolytica cysts. In India water supply poses big problem due to faecal contamination of water[18].

- Hookworm was the most common helminthic infestation found in our study (7.23% in hospital children and 8.28% in rural school children), which is consistent with Dakshina bisht et all study [18], followed by Ascaris lumbricoides (2.06% hospital children and school children 2.22%), which is consistent with Dakshina Bisht etal (6.2%); but much lower when compared with other studies like Wani etal 2010 (71.58%) [20] and high when compared with Kaur etal (0.8%)[21]. Very low prevalence rate was observed for Enterobius, H.nana in our studies, which is consistent with other studies [3,7,18]. Total of 2 cases of Strongyloides larva was observed in our study among hospital patients (1 adult and 1 child) and they were immuno-competent patients. Taenia species, Trichuris trichiura which are commonly observed in other studies[3,7,18] , not found in our study. In our study we observed that community people in around Kancheepuram are not eating either beef or pork, this can be another reason for not finding the Taenia species[9]. Dual infection or polyparsitism was also not observed.
- In few cases, 11 (7 children + 4 adults) out of 777 were positive for trophozoites of E .histolytica and 6 (5 children+ 1 adults) out of 127 were positive for trophozoites of Giardia lamblia. All these trophozoite positive (both E .histolytica and Giardia) cases were hospital patients. All 7 children with acute amoebic dysentery and 5 children with severe acute diarrhoea due to giardiasis were hospitalized (3.1%), for further management. We observed only few cases of trophzoites of E.histyolytica and Giardia lamblia probably due to early disintegration motile trophozoites as soon they are passed in stool.

In our study we observed that, parasite infestation rates are much higher among children as compared to in adults[22]. Age is an important risk factor for IPIs and preschool and school going children have been reported to be at highest risk for IPIs [9].Adults have much lesser rates of IPIs may be due to the fact that as children grow older they follow better hygienic practices [21]. The variations in the prevalence of IPIs in different studies could be attributed to the time of study and geographical differences in the area[7].

Strength & limitations: As per our knowledge this study is one of the few studies where in attempts have made to compare the rates of IPIs among adults with that of children; it also included comparison of IPIs between hospital children with that of rural school children. The

stool sample testing was done by routine saline and iodine mount followed by concentration technique, which increased the validity of the results.

3 stool samples over a period of several days should be examined; not to miss intermittent shedding of intestinal parasites in stool samples. Because of resource constraints, we could examine only one stool sample. However recent studies have suggested that 1 or 2 stool samples examination can detect up to 90% of the IPIs [7,18].

In order to obtain an accurate burden and cause of parasitic infection needs more a lager sample size and prolonged longitudinal study considering more parameters for epidemiological surveillance.

CONCLUSION: Human parasitic infection is a global problem of enormous proportion, responsible for mild but chronic morbidity. IPIs are highly prevalent in our area. Poor hygienic practices are important factors associated with IPIs. Age is also an important predicator of IPIs in 5-12 year old school children. There is a need to promote mass scale deworming programmes and health education about hygienic habits in schools to create awareness about health and hygiene, which is required to control parasite load among rural children in India. However, even though antihelminthic and antiprotozoal drugs are easily available, IPIs rates are not declining. Hence, regular surveys and mass scale deworming government programmes should be a regular ongoing process. Primary prevention is the key for eradication. The following Pentavalent measures are to be implemented at micro level, targeting each family, school and the village as a unit for implementation.

1. Sanitation: the sanitation system and human excreta disposal models to be made cost effective and available, accessible, affordable and acceptable to the local community, culturally and socially.
2. Safe water supply, with emphasis on boiling before consumption
3. Food hygiene as per public health regulations
4. Food handlers – focused health education, periodic examination and treatment
5. Effective health education on food hygiene, at individual, family and community levels.

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Table-1: Overall results obtained from hospital patients and school children-

I.Among 2654 hospital patients:	
Adults (2267)	
Adult male	1047 (46.18%)
Adult female	1220 (53.82%)
Children (387)	
Boys	200 (51.67%)
Girls	187 (48.32%)
II.School children (314):	
Boys	163 (51.9%)
Girls	151 (48.08%)

Table – 2: Parasitic infection in relation to sex and age at MMCH & RI (Hospital patients)

Sex	**Age**	**Total no. of samples**	**Positive**	**Percentage**
Adult male	>12 yrs	1047	390	37.24%
Adult female	> 12yrs	1220	349	28.60%
Boys	5-12yrs	200	126	63.00%
Girls	5-12yrs	187	89	47.60%
Overall (Adults +Children)		2654	954	35.94%
Overall Children	5-12yrs	387	215	55.55%
Overall Adults	> 12 yrs	2267	739	32.59%

Table – 3: Protozoal infection in relation to sex and age at MMCH & RI (Hospital patients)

Sex	**Age**	**Total no. of samples**	**Positive**	**Percentage**
Adult male	>12 yrs	1047	288	27.50%
Adult female	> 12yrs	1220	239	19.59%
Boys	5-12yrs	200	106	53.00%
Girls	5-12yrs	187	71	37.96%
Overall children	5-12yrs	387	177	45.73%
Overall adults	> 12 yrs	2267	527	23.24%
Overall (Adults+Children)		2654	704	26.52%

Table– 4: Helminthic infection in relation to sex and age at MMCH & RI (Hospital patients)

Sex	**Age**	**Total no. of samples**	**Positive**	**Percentage (%)**
Adult male	>12 yrs	1047	102	9.74%
Adult female	> 12yrs	1220	110	9.01%
Boys	5-12yrs	200	20	10%
Girls	5-12yrs	187	18	9.62%
Overall children	5-12yrs	387	38	9.81%
Overall adults	> 12 yrs	2267	212	9.35%
Overall (Adults+Children)		2654	250	9.41%

Table – 5: Parasitic infection among school Children at Kancheepuram in relation to sex and age

Sex	Age	Total no. of samples	Positive	Percentage
Boys	5-12yrs	163	85	52.14%
Girls	5-12yrs	151	93	61.58%
Overall children		314	178	56.68%

Table – 6: Protozoal infection among school children at Kancheepuram in relation to sex and age

Sex	Age	Total no. of samples	Positive	Percentage
Boys	5-12yrs	163	69	42.33%
Girls	5-12yrs	151	77	50.99%
Overall children		314	146	46.49%

Table – 7: Helminthic infection among school children at Kancheepuram in relation to sex and age

Sex	Age	Total no. of samples	Positive	Percentage
Boys	5-12yrs	163	16	9.8%
Girls	5-12yrs	151	16	10.59%
Overall children		314	32	10.19%

Table – 8: Intestinal Parasitic distribution in stool specimen among adult males and females at MMCH & RI

Protozoans (Cyst+ Trophozoites)	Parasites	Total no. of Positive in Males (n-1047)	%	Total no. of Positive in Females (n-1220)	%	Total
	Entamoeba histolytica/ dispar / moshkovskii	243	23.20%	204	16.72%	647/2267=28.53%
	Giardia lamblia	45	4.29%	35	2.86%	80/2267=3.52%
Helminths	Ascaris lumbricoides	31	2.96%	25	2.04%	56/2267=2.47%
	Hookworm	66	6.30%	81	6.63%	147/2267=6.48%
	Enterobius vermicularis	2	0.19%	1	0.08%	3/2267=0.13%
	Hymenolepis nana	1	0.09%	2	0.16%	3/2267=0.13%
	Strongyloides larva	2	0.19%	1	0.08%	3/2267=0.13%

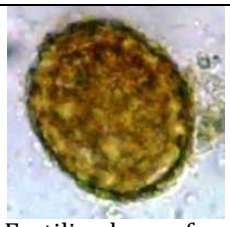
Table – 9: Intestinal Parasitic distributions in stool specimen among children at MMCH and RI.

Protozoans (Cyst+ Trophozoites)	Parasites	Total no. of Positive in boys (n-200)	%	Total no. of Positive in girls (n-187)	%	Total
	Entamoeba histolytica/ dispar / moshkovskii	78	39.00%	52	27.80%	130/387=33.59%
	Giardia lamblia	28	14.00%	19	10.16%	47/387=12.14%
Helminths	Ascaris lumbricoides	5	2.5%	3	1.60%	8/387=2.06%
	Hookworm	15	7.5%	14	7.48%	29/387=7.23%
	Enterobius vermicularis	0	-	0	-	-
	Hymenolepis nana	0	-	0	-	-
	Strongyloides larva	0	-	1	0.53%	-

Table – 10: Parasitic distributions in stool specimen among school children at Kancheepuram.

Protozoans (Cyst+ Trophozoites)	Parasites	Total no. of Positive in boys (n-163)	%	Total no. of Positive in girls (n-151)	%	Total
	Entamoeba histolytica/ dispar / moshkovskii	52	31.90 %	56	37.08%	108/314=33.91 %
	Giardia lamblia	17	10.42 %	26	13.90%	43/314=13.69 %
Helminths	Ascaris lumbricoides	2	1.25%	7	4.64%	9/314=2.22%
	Hookworm	17	6.75%	9	5.96%	26/314=8.28%
	Enterobius vermicularis	3	1.84%	-	-	3/314=0.9%
	Hymenolepis nana	-	-	-	-	-
	Strongyloides larva	-	-	-	-	-

Figure 1-Microscopic photographs (Saline/Iodine mount) of some of the parasites encountered during our research study

 Cyst of Entamoeba histolytica/ dispar / moshkovskii	 Cyst of Giardia lamblia	 Fertilized egg of Ascaris lumbricoides	 Unfertilized egg of Ascaris lumbricoides
 Egg of hookworm	 Egg of Hymenolepis nana	 Egg of Enterobius vermicularis	 Strongyloides larva