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Prevalence and risk factors associated with intestinal parasitic infestations in the rural pediatric population of Piparia, Gujarat - A hospital-based study

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ABSTRACT

Background: Intestinal parasitic infections have always been an important public health problem in the tropics, particularly in developing countries like India. **Objectives:** The objective of this study is to assess the burden, magnitude, risk factors, and patterns of intestinal parasitism in the pediatric population admitted to tertiary care hospital, Vadodara, Gujarat. **Materials and Methods:** A total of 101 pediatrics patients of 2-12 years of age group were included in this cross-sectional study. Stool samples were collected and were processed by saline mount and iodine mount. Various risk factors such as socioeconomic status, hand washing, type of drinking water, literacy rate of parents, and malnutrition were analyzed. **Results:** The overall prevalence rate of parasitic infestation was 17.8% (18/101). *Giardia lamblia* (5/18, 27.7%) was the most common parasite followed by *Ancylostoma duodenale* (4/18, 22.2%), fertilized egg of *Ascaris lumbricoides* (3/18, 16.6%), *Entamoeba histolytica*/*dispar* (2/18, 11.1%), *Entamoeba coli* (2/18, 11.1%), *Hymenolepis nana* (1/18, 5.5%), and *Taenia* species (1/18, 5.5%). While comparing the risk factors, we found that 94.4% infection rate was associated with drinking water directly from open well, 88.8% in those with faulty hand washing, 77.7% of infection was associated with male gender, 72.2% rate in a child whose mother was illiterate and those using open defecation. **Conclusion:** Intestinal parasitic infestation is still a cause of morbidity in children; therefore, there is dire need for regular awareness programs on good sanitary and hygienic practices in the rural population. In the era of Swachh Bharat Mission, this is very important indirect monitoring of safe water supply, toilet use, and use of deworming at large scale.

KEY WORDS: Children; Intestinal Parasitic Infestation; Risk Factors; Water Improved Sanitation and Adequate Hygiene Behaviors

INTRODUCTION

Parasitic diseases have been with humanity since time immemorial.[1] Even today, these diseases remain among the major cause of human melancholy and death in the world and are an important impediment to the development of economically less privileged countries.[1] The World Health Organization (WHO) has suggested that the control of parasitic infestation should be effectively incorporated into a multidisease control approach together with tuberculosis, malaria, and HIV/AIDS, and the prevalence rate should be reduced by 10% every year to improve the health economics of the developing countries.[2] It is estimated that some 3.5 billion people are affected and that 450 million are ill as a result of these infections, the majority being children.[3] The WHO estimated that globally, there are 800-1000 million cases of ascariasis, 700-900 million of hookworm infection, 500 millions of trichuriasis, 200 million of giardiasis, and 500 million of amoebiasis.[4] Intestinal

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helminths infestations are the most common infestations among school-age children and they tend to occur in high intensity in this age group and lead to nutritional deficiency, including iron deficiency anemia, seizures, portal hypertension, chronic diarrhea, and impaired physical development in children which will have negative consequences on cognitive function and learning ability.[5,6] The lack of access to clean water, improved sanitation and adequate hygiene (WASH), low socioeconomic status, illiteracy, hot and humid tropical climate, and inadequate medical care largely attributes to the burden of these neglected tropical diseases.[7,8] In addition, intestinal parasitic agents increase in polluted environments such as refuse heaps, gutters and sewage units in and around human dwelling, and living conditions of the people in crowded or unhealthy situations.[9] Therefore, this study was designed to assess the burden, magnitude, and patterns of intestinal parasitism and to identify risk factors associated with parasitic infestation in the rural pediatric population admitted to Dhiraj hospital, Piparia, Vadodara, Gujarat.

MATERIALS AND METHODS

This cross-sectional study was carried out in 101 pediatric patients admitted to tertiary care hospital, affiliated with S.B.K.S Medical Institute and Research Center, Sumandeep Vidyapeeth, Piparia. This study was executed for 1 year, that is, may 2015-april 2016. Children between 2 years and 12 years were included in the study. This study was commenced only after getting the ethical approval from Sumandeep Vidyapeeth Institutional Ethical Clearance.

Sample Size Calculation

The sample size was calculated according to the latest study on the prevalence of parasitic infection among population of Gujarat - the prevalence of 15.19% was found as per the study conducted by Shobha et al.,[10] sample size calculated with formula 4 pq/L^2, taking 95% confidence interval (CI) with 7% error of estimation. The required sample size was 100 study participants. A simple random sampling method was used to collect sample from hospital and successfully, 101 samples were collected.

Study Procedure

After taking the oral consent from the parents/guardian of the child, a standard pre-designed and pre-tested questionnaire regarding the demographic variables was interrogated to the mother/father. The details asked were regarding to their living conditions includes the income of family, family size, occupation, literacy of parents, type of housing, type of drinking water, method of purification, type of toilet facility, hand washing before meals and after defecation, and malnourished condition. The data were further analyzed with the presence and absence of parasitic infestation.

Sampling

A total of 101 stool samples were collected in a wide mouth, labeled, leak proof, clean, and sterile plastic containers (procured from HiMedia) and were transported to Central Research Laboratory within 1 hour of collection.

Macroscopic examination (naked eye) of the stool was done for color, consistency, presence of mucus, blood or any segments, or adult worm of helminths.

Microscopic examination of the stool was done by:

a. Direct examination (0.85% normal saline) was done for the presence of white blood cell, Charcot–Leyden crystals, cyst, trophozoite, and bile stained eggs.
b. Lugol's iodine mount was done for the demonstration of cyst and eggs.

All the negative stool samples were concentrated using formalin-ether concentration methods and examined again for the parasites before declaring negative.

Statistical Analysis

Statistical analysis was performed using SPSS version 16 (SPSS Inc., Chicago, IL, USA) with the help of statistician. $P < 0.05$ is considered significant, odds ratio (OR) and 95% CIs of OR were also reported.

RESULTS

A total 101 stool samples from 74 male children and 27 female children were included in the present study, out of which 18 (17.8%) were positive either for protozoan or helminths infections (Table 1). Table 2 summarizes the equal distribution of protozoan and helminths infestation irrespective of gender (9/18, 50%), higher rate of helminths infection in males (8/14), and protozoa's in female (3/4). Overall, the infection rate was higher in males (14/18, 77.7%) compared to female (4/18, 22.2%). Age-group mainly affected in children was below 5 years in males (64.2%, 9/14) and above 5 years in females (100%, 4/4). *Giardia lamblia* infection was the most common infection constituting (n=5, 27.7%), followed

Table 1: Prevalence of helminthic and protozoal infection (n=101)

Parasite	Prevalence (%)
Giardia lamblia	5 (4.95)
Ancylostoma duodenale	4 (3.96)
Fertilized egg of Ascaris lumbricoides	3 (2.97)
Entamoeba histolytica/dispar	2 (1.98)
Entamoeba coli	2 (1.98)
Hymenolepis nana	1 (0.99)
Taenia species	1 (0.99)
Total positive	18 (17.8)

by *Ancylostoma duodenale* (*n*=4, 22.2%), fertilized egg of *Ascaris lumbricoides (n*=3, 16.6%), *Entamoeba histolytica/ dispar* (*n*=2, 11.1%) with *Hymenolepis nana,* and *Taenia* species one each (5.5%) (Table 1). In the present study, most of the cases were observed in the warm season (February to July), especially in the month of April as compared to cooler season (August to January) (Figure 1).

WASH Behaviors (Table 3)

Based on the findings of the questionnaires achieved with children and their parents, most children (93/101, 92%) reported to wash their hands with only water before eating, after defecation, and even after playing, while only 8% of children reported to wash hand with soap. Parasitic infestation rate was almost 89% in those who were washing hands with only water. Almost 68% of the children reported defecating open in the fields and bushes. Only 32% of the households had access to an improved private latrine. Parasitic infection was found 72% in those defecating in open with a risk of 1.25 times more than those using the private sanitary facility (OR-1.25). Nearly 88% of children drink water directly from the open well without using any water purification method like filter or boiling. Very few cases (12%) were found to use municipal water with boiling as a method of water purification. Parasitic infection was almost 94% in those children consuming water directly from the open well (OR-2.59). Nearly 41.5% (42/101) of the child was malnourished due to poverty; they all were underweight with low BMI. Univariate analysis showed that malnutrition (OR-2.63, P = 0.05) was significantly associated with an increased risk for an intestinal parasitic infection. It's a well-recognized truth that the mother's education is very imperative for the overall well-being and growth of any child, in the present study we found that 42% of the mothers were absolutely illiterate, which predispose her child for developing parasitic infections (72% rate, OR 3.00, P = 0.05) with 3-fold risk.

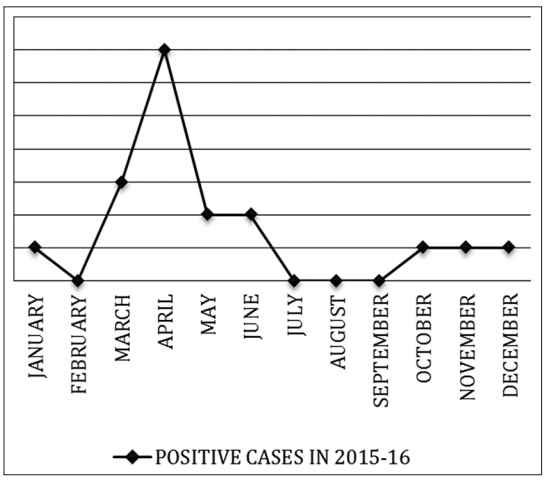

Figure 1: Seasonal variation of cases

DISCUSSION

Intestinal parasitic infestation represents a large and serious medical and public health problem in developing countries. In the present study, we screened the stool sample of children from Piparia village admitted at Dhiraj Hospital for diverse reasons. The overall prevalence rate of parasitic infestation was 17.8%, among these 4.95% were *Giardia*, 3.96% were eggs of *A. duodenale,* 2.97% were eggs of *A. lumbricoides*, 1.98% were cyst of *E. histolytica* and *E. coli*, and 0.99% were eggs of *H. nana* and *Taenia* species. It was considered as a higher rate of prevalence, as these children were asymptomatic for parasitic infestation. Various studies from rural, urban, and semi-urban regions have shown different prevalence rates, ranging from 6.63% to 46.7%.[11-14] The prevalence of parasite also exhibits wide variation from state to state, country to country, between geographical areas, communities, and even seasons.[15] To find out the cause of such asymptomatic carriage in children, the present study evaluated various risk factors contributing to infections. In the present study, poverty was the main predictor for a parasitic infection in these pre-school and school children. Poverty is usually associated with poor personal and food hygiene habits such as eating raw/unwashed vegetables, malnutrition, absence of handwashing before eating and after defecation, lack of toilet facility, poor sewage network coverage, and poor environmental conditions, such as living in crowded houses, and above all lack of mothers education.[16,17] While comparing the risk factors, we found that 78% of infection was associated with male gender, 50% infection rate in a child whose father was uneducated, and 72% rate in a child whose mother was uneducated with 3 times more risk of developing

Table 2: Distribution of helminth and protozoa in different gender

Infections	Parasite detected	Male *n*=74 (%)	Female *n*=27 (%)
Protozoa (*n*=9)	*Entamoeba histolytica* (*n*=2)	1 (1.35)	1 (3.7)
	Entamoeba coli (*n*=2)	1 (1.35)	1 (3.7)
	Giardia lamblia (*n*=5)	4 (5.4)	1 (3.7)
Helminth (*n*=9)	Egg of *Ancylostoma duodenale* (*n*=4)	3 (4.05)	1 (3.7)
	Fertilized egg of *Ascaris lumbricoides* (*n*=3)	3 (4.05)	-
	Egg of *Hymenolepis nana* (*n*=1)	1 (1.35)	-
	Egg of *Taenia* species (*n*=1)	1 (1.35)	-
Total		14 (18.9)	4 (14.8)

Table 3: Sociodemographic characteristics and personal hygiene of the patients for evaluating various risk factors

Characteristics	Parasite positive (*n*=18)	Parasite negative (*n*=83)	Total	*P* value (CI)	OR
Gender					
Male	14	60	74	0.63 (0.3998-4.502)	1.34
Female	4	23	27		
Age (years)					
Below 5	9	42	51	0.96 (0.3523-2.705)	0.98
Above 5	9	41	50		
Father's education					
Primary	4	26	30	0.48 (0.5185-4.005)	1.44
Secondary	5	23	28		
No education	9	34	43		
Mother's education					
Primary	3	19	22	0.05* (0.9818-9.167)	3.00
Secondary	2	25	27		
No education	13	39	52		
Type of toilet facility					
Open field	13	56	69	0.69 (0.4053-3.877)	1.25
Private	5	27	32		
Category of drinking water					
Municipal water supply	1	11	12	0.37 (0.3135-21.51)	2.59
Open well	17	72	89		
Family size					
Small (<4)	9	46	55	0.67 (0.2900-2.231)	0.80
Large(>4)	9	37	46		
Habit of hand washing after defecation and before meals					
Only water	16	77	93	0.5 (0.1152-3.373)	0.62
With soap	2	6	8		
Malnourished					
Yes	11	31	42	0.05* (0.9254-7.508)	2.63
No	7	52	59		

CI: 95% confidence interval, **P*<0.05 is significant, OR: Odd ratio

infection. In a study conducted by Celiksöz et al.,[18] higher percentage of children born to uneducated mothers were found positive for intestinal parasites (69%). Okyay et al.[5] observed that mother's education was crucial for the proper guidance of growing children. Infection rate was higher in those using open field defecation (72%), hand washing with only water (89%), malnourished (61%) being at a risk of 2.6 times more than a healthy child, 94.4% in those using drinking water directly from open well, and with a risk of 2.5 times more than those using municipal water. The study conducted by Assudani et al.[19] also noted that 56.11% cases were having drinking water from open well. Because these wells are constructed at shallow level, they can come in contact with outer atmosphere and provide optimum condition for the survival and development of eggs[20] Stephenson et al.[21] and Oyewole et al.[22] have also found association of parasitic infections with intake of ring-well water and river water. Different studies have proved that untreated water is the main cause of intestinal infections.[23,24] These factors reflect the living conditions, lifestyle, and environmental conditions of the local population. The level of gastrointestinal disease associated with the feco-oral route of transmission could be decreased significantly by implementing relatively simple strategies, such as better waste water treatment and hygiene education.

CONCLUSION

The prevalence of 17.8% shows that intestinal parasitic infection is still a major public health problem in children. It was found higher than the previous study conducted in same district. This may be due to the present study was conducted in the rural area. This study was conducted after implementation of Swachh Bharat Abhiyan by Prime Minister of India. This is an important indirect monitoring tool for effective implementation of Swachh Bharat Abhiyan and safe water supply to all. Furthermore, it is measuring impact of deworming program of

the government. Interventions including health education and personal hygiene to children and their parents are required. Factors such as faulty handwashing, open field defecation, untreated drinking water, malnutrition, and illiteracy provide negative consequence for the holistic development of a school going child. There is need to promote mass scale deworming and health promotion campaigns to create awareness about health and hygiene in rural population.

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