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Original article

Parasites Causing Diarrhea– Is the trend really changing?

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ABSTRACT

Background: Intestinal parasitic infections are endemic and they constitute a serious public health problem in developing nations. These are a major cause of morbidity and mortality especially in children and high-risk individuals in the tropical and subtropical countries. **Objectives:** To observe the trend of parasitic infection in North India. **Methods:** This study was done in the diarrhea laboratory of a tertiary care hospital, New Delhi. Five years data (2011- 2015) of stool samples analysis of patients with symptoms suggestive of parasitic diarrhea were analyzed. All samples were processed by macroscopic examination, saline and iodine wet mount, and modified Ziehl-Neelsen's staining (wherever required).When required, concentration was done by saturated salt solution and/or formalin-ether sedimentation technique. **Results:** Total 11571 stool samples were processed during the study period of which 3.87% (449/11571) had parasites. The infection was more common in males and in <12 years age [239/440(53.00%)].Protozoan infection was more common [327(72.82%)]than helminthes with a rising trend from 2011 to 2015.Most common parasites isolated were *G. lamblia* (44.32%), *A. lumbricoides* (20%) and *E.histiolytica* (16.70%). **Conclusion**: Parasitic infection is highly prevalent in north India. , more common in males and in children < 12 years of age. Protozoan infections is more prevalent than helmintic infections, *G.lamblia* and *E. histiolytica* being the commonest parasites isolated. There is need for regular health education and awareness regarding personal hygiene, good sanitation practices, clean drinking water supply and regular deworming programs.

KEYWORDS: Diarrhea**,** Intestinal parasites, Cryptosporidium.

INTRODUCTION

Infectious diseases are observed as an universal problem which is intensified by various socioeconomic, demographic, environmental, and microbial changes.[1]Intestinal parasitic infections are endemic and they constitute a serious public health problem especially in developing countries like India, adding to a major cause of morbidity and mortality mostly in children and amongst high-risk groups.[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 prevalence of parasitic diseases varies in different countries depending upon the factors like poverty, malnutrition, personal and environmental hygiene, population density, poor sanitation, hot and humid climatic conditions.[2]

Illiteracy of people belonging to lower socio-economic class and their lack of awareness about importance of sanitation and personal hygiene is a major factor responsible for parasitic infections as these are mostly acquired by ingestion, inhalation or penetration of skin by infective forms.[4]The evolution of these parasites and the morbidity that it causes on the modern humans have made it a global threat especially hindering the socioeconomic, political and educational development of the developing world.[5]

Such data on prevalence of parasitic infections exists in different parts of our country but a continuous feedback and awareness is very essential to know the etiological agents so as to improve the disease management and control. Hence, to see the trend of parasitic infection in New Delhi, this retrospective study was done in a tertiary care hospital by analyzing the data of stool samples analysis of patients with symptoms suggestive of parasitic diarrhea.

MATERIALS AND METHODS

This retrospective study was carried out in the department of Microbiology of a tertiary care hospital in New Delhi, India by analyzing the data of stool samples received between January 2011 and December 2015. Data of stool sample analysis of patients with symptoms suggestive of parasitic infections were included in the study. The stool samples were collected in a wide mouthed clean, dry plastic container without preservatives and were processed in the laboratory within two hours of collection. Macroscopic examination was done to look for color, consistency, presence of mucus and blood, and presence of parasitic structures such as proglottids, scolices, adult tapeworm, enterobius, ascaris, or hookworm. Saline wet mount was done to detect protozoal trophozoites and helminthic eggs or larvae and iodine wet mount was done to detect cysts.[6]

Modified Ziehl-Neelsen's staining method was done to detect Oocysts of *Cryptosporidium parvum*or *Isospora belli* in clinically suspected or immunodeficiency cases.[7] Concentration was done by saturated salt solution technique and formalin-ether sedimentation technique where it was negative by saline wet mount but had a strong suspicion of parasitism.[8]

The statistical analysis was carried out using SPSS software version 17.0. Data were presented as percentages and proportions. Chi-square test was applied when two or more set of variables were compared. The critical value of 'p' indicating the probability of significant difference was taken as <0.05.

RESULTS

A total of 11571 samples were received in the laboratory during the study period of which 449 samples were positive for the parasites. The infection was marginally more in males (55.01%) (Male: Female ratio of 1.22) and in children<12 years [238/449(53%)].The difference in age and sex wise distribution of parasitic infection was statistically insignificant (p >0.05). We observed a rising trend of parasitic infection from 2011 to 2015 except for the year 2014 (Table1).

Table: 1 Demographic profile of total and positive samples received over five years (N=11571)

Years	Total number of samples	Total number of positive samples				N(%) of Total positive samples received
		Females (Age in years)		Males (Age in years)		
		<=12	>12	<=12	>12	
2011	2234(19.30)	8(3.96)	12(5.94)	11(4.45)	27(10.93)	58(2.59)
2012	2150(18.58)	15(7.42)	21(10.49)	20(8.09)	25(10.12)	81(3.76)
2013	2298(19.85)	27(13.36)	24(11.88)	39(15.78)	18(7.28)	108(4.69)
2014	2549(22.02)	22(10.89)	19(9.40)	26(10.52)	14(5.66)	81(3.17)
2015	2340(20.22)	28(18.81)	26(12.87)	42(17)	25(10.12)	121(5.17)
Total	**11571(100)**	**100(49.50)**	**102(50.49)**	**138(55.87)**	**109(44.12)**	**449(3.88)**
		202(44.98%)		**247(55.02%)**		

Table:2 Age and Percentage distribution of different parasites isolated in Five years (N=449)

Type of Parasites	Parasites	2011		2012		2013		2014		2015		Total
		<=12yr	>12yr	<=12yr	>12yr	<=12yr	>12yr	<=12yr	>12yr	<=12yr	>12yr	
Helminthes (27.17%)	***A.lumbricoides***	3	2	6	6	24	12	16	8	8	5	**90 (20.04%)**
	H.nana	1	-	2	-	3	1	4	-	5	-	**16 (3.56%)**
	Trichuris spp.	-	-	1	-	1	-	-	1	2	1	**6(1.33%)**
	Taenia spp.	-	-	-	1	-	1	1	2	-	-	**5 (1.11%)**
	A.duodenale	-	1	-	1	1	-	-	-	-	-	**3 (0.66%)**
	Strongyloides spp.	-	-	-	1	-	-	-	-	-	-	**1(0.22%)**
	E.vercicularis	-	-	-	-	1	-	-	-	-	-	**1(0.22%)**
Protozoans (72.83%)	***G.lamblia***	14	22	19	20	20	10	19	11	37	27	**199 (44.32%)**
	E.histolytica	1	3	2	11	3	5	8	9	18	15	**75(16.70%)**
	B.hominis	-	-	-	-	13	8	-	-	-	-	**21(4.67%)**
	Isospora spp.	-	8	2	3	-	2	-	1	-	-	**16 (3.56%)**
	Cryptosporidium spp.	-	2	3	3	-	3	-	1	-	3	**15 (3.34%)**
	Microsporidium spp.	-	1	-	-	-	-	-	-	-	-	**1(0.22%)**
		19	**39**	**35**	**46**	**66**	**42**	**48**	**33**	**70**	**51**	
Total(N=449)		**58(12.92)**		**81(18.04)**		**108(24.05)**		**81(18.04)**		**121(26.95)**		**449(100%)**

The incidence was highest in 2015(122)and lowest in 2011 (58). Protozoal cysts/ trophozoites were detected in 327(72.82%) samples and helminthic eggs/ova/worms were detected in 122(27.17%) samples. The parasites most commonly isolated were *G. lamblia* (44.32%), *A. lumbricoides* (20%) and *E. histolytica* (16.7%) whereas, *E. vermicularis*, *Strongyloides spp*. and *Microsporidium spp*. were least commonly isolated (Table 2).Others parasites isolated were *A. duodenale* (0.60%), *Taenia spp.* (1.11%), *Trichuris spp*. (1.33%), *Cryptosporidium spp.* (3.34%). *Isospora spp.*, *H. nana* (3.57% each,) and *B. hominis* (4.60%).

Over all G. *lamblia* (44.32%)was the most common isolated parasite in our study. Other common parasites isolated in different years were, *Isospora spp*. in 2011 (14.01%), *E. histolytica* in 2012 (16%), *A. lumbricoides* in 2013 (33.3%) and 2014 (29.6%) and *E. histolytica* in 2015(27.27%). Only one isolate (0.22%) of *Microsporidium spp.* was isolated in 2011 (Table 3).

Table 3: Year wise distribution of different parasites from 2011-2015 (N=449)

Parasites (Number)	**2011**	**2012**	**2013**	**2014**	**2015**
A. Lumbricoides(N=90)	5(5.55)	12(13.33)	36(40)	24(26.66)	13(14.44)
H.nana (N=16)	1(6.25)	2(12.5)	4(25)	4(25)	5(31.25)
Trichuris spp.(N=6)	0(0)	1(16.66)	1(16.66)	1(16.66)	3(50)
Taenia spp. (N=5)	0(0)	1(20)	1(20)	3(60)	0(0)
A. Duodenale(N=3)	1(33.33)	1(33.33)	1(33.33)	0(0)	0(0)
Strongyloides spp.(N=1)	0(0)	1(100)	0(0)	0(0)	0(0)
E. vermicularis(N=1)	0(0)	0(0)	1(100)	0(0)	0(0)
G. lamblia(N=199)	36(18.09)	39(19.59)	30(15.07)	30(15.07)	64(32.16)
E.histiolytica(N=75)	4(5.33)	13(17.33)	8(10.66)	17(22.66)	33(44)
B. Hominis(N=21)	0(0)	0(0)	21(100)	0(0)	0(0)
Isospora spp.(N=16)	8(50)	5(31.25)	2(12.5)	1(6.25)	0(0)
Cryptosporidium spp.(N=15)	2(13.33)	6(40)	3(20)	1(6.66)	3(20)
Microsporidium spp.(N=1)	1(100)	0(0)	0(0)	0(0)	0(0)
Total(N=449)	**58(12.92)**	**81(18.04)**	**108(24.05)**	**81(18.04)**	**121(26.95)**

DISCUSSION

Diarrhea being a major cause of morbidity and mortality in India, a constant updated knowledge regarding the commonly prevalent parasites is required so that the empiric anti- parasitic treatment, if required can be initiated against the locally prevalent pathogens. Our hospital is a tertiary care hospital in the capital city of India which caters mainly patients of lower and middle socioeconomic class and it has an annual out patient's department attendance of approximately one million. This explains the vast sample size in our study.

Most of the studies conducted in India have restricted themselves to narrow groups like infants, children, HIV positive patients, etc. or have included both bacterial and parasitic pathogens causing diarrhea, or focusing only on the bacterial pathogens. However, there are very few recently published studies available which have focused only on the parasites causing diarrhea. Moreover, very few data are available that have included large sample size (comparable to our sample size) that would reflect the changing trends of locally prevalent parasites.

In the present study parasitic infection was seen in 3.87% of cases which is less as compared to studies from other parts of India like those by Singh, et al. [2] (6.68%),Shrihari, et al. [4] (24.78%), Sahai, et al. [5] (17.6%) and Davane, et al. [9](6.63%). The lower prevalence rate in our area probably indicates a better awareness of personal hygiene and environmental sanitation amongst the general population and also a supply of clean drinking water in our area.

We found that the infection was marginally more in males (55%) as compared to females (45%). But, the difference was not that significant. However, other Indian studies have reported the parasitic infection to be significantly more in male patients. [10, 11, 12] However, in two other studies from India the difference in two sexes was not that significant as in case of ours. [2, 4]The Indian males are more involved in outdoor activities and migration for jobs as compared to females which might be the cause of their excessive exposure to unhygienic environmental conditions leading to higher rate of infections.

In the current study the prevalence is comparatively more common in children<12 years (53%) than in adults. Similar finding was seen in a study by Parameshwarappa, et al.[13] in 2012, where the prevalence in children <10 years was 80% which was more as compared to our study. However, Singh, et al. [2]and Kang, et al. [14] in their study reported that older children and adults had a higher prevalence of parasitic infections as compared to preschool children. The higher rate of parasitic infections in children might be due to higher exposure to parasites due to more of their involvement in outdoor activities and it can also be due to lack of awareness about personal hygiene and sanitation amongst the children.

We found that the Protozoans (72.83%) were the major offenders of parasitic diarrhea as compared to the helminthes (27.17%). Similar finding was also seen in another study in Haryana in 2013. [2]The parasites mostly we isolated were *G. lamblia* (44.32%), *A. lumbricoides* (20%), *E. histiolytica* (16.70%). Whereas, *E. vermicularis* and *Strongyloides spp*. and *Microsporidium spp*. were the least commonly isolated parasites (0.22% each). Similar to ours, in MexicoQuihui, et al. [15] reported *G. lamblia*to be commonest parasites isolated. In another study from our hospital in 2002 by Kaur, et al. [16] amongst children with diarrhea, *Cryptosporidium spp.* was the most commonly

isolated parasite (24%) while G. *lamblia* and *E. histiolytica* were isolated in 11% cases each. But in our study isolation of *G lamblia* and *E. histiolytica* was comparatively high. We isolated Cryptosporidium *spp*., *Isospora spp.* and *Microsporidium spp.* in only 3.34%, 3.56% and 0.22% cases respectively and all of them were isolated from Human immune-compromised Virus (HIV) reactive individuals.

Now a days, there is an increase awareness amongst the clinicians about the early initiation of antiretroviral therapy thus decreasing the rate of opportunistic infections. This may be a reason of decreased rate of isolation of *Cryptosporidium* spp in our study. It is also essential that all the HIV reactive individuals with diarrhea should be screened for these parasites with acid fast screening of the stool. In studies conducted by Srihari, et al. [4] and Ashok, et al. [2] the most commonly isolated intestinal parasite was *E. histiolytica* (43.8% and 50% respectively).

While, Choubsia, et al. [17] in2006 and Ibidapo, et al. [18] in2008 reported *A. lumbricoides*as commonly isolated parasite. Ibidapo, et al. [18]in their study conducted in Nigerian population have found the prevalence of Hookworm to be 45% , *Trichuris trichiura* 31.3% and *Strongyloides stercoralis* 18% which were very high as compared to our study. Dhanabal et al [19] in Chennai, India, had isolated *Entamoeba coli* (23%), *Cyclospora* spp. (22.2%), *E.histolytica*(21.8%), *G. intestinalis*(14.4%), *A. lumbricoides*(6.2%), *T.trichiura*(1.1%), and *H. nana* (2.7%). In our study no *Cyclospora spp*. were isolated. The isolation of *B. hominis* (4.67%) was very less in our study, while Fellani et al [20] in Libya in 2007, found that the prevalence of *B. hominis*was very high i. e 26.58%. It might be due to difference in prevalence of different parasite in different geographical location.

The limitation of our study is that we have included a large compiled sample size of 11571, so very limited numbers recently published comparative data are available in India that met our inclusion and exclusion criteria.

CONCLUSION

Parasitic infection is very much prevalent in Delhi and it seeks immediate attention. Protozoan infection is more common than helminthic infection. It is more prevalent amongst the males and in children <12 years of age. *G. lamblia* and *E. histiolytica* are the most common parasites prevalent in north India. Even though these infections are not life threatening but they can lead to serious physical and mental growth retardation especially in growing children making them susceptible to various other infections.

It is also important to enhance the resources in diagnostic microbiology laboratories so as to screen the stool samples for every possible intestinal parasites. Our study emphasizes the need of regularly updated health education and awareness programs regarding personal hygiene, good sanitation practices, use of safe drinking water and regular deworming programs in Delhi and North India.

Competing interest: The authors declare that they have no competing interests.

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