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Predominance of Gastrointestinal Protozoan Parasites in Children: A Brief Review

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Abstract

Intestinal parasitic infections are among the major diseases of concern to public health throughout the world [1]. About 25% of world's population suffers from one or more kinds of intestinal parasitic infections (helminthes/protozoa). Children because of their complex nutritional requirements and less developed immune systems are observed to be the principal sufferers of these parasitic infections [2]. Moreover, they have an extremely delicate physiology which can result in severe upsetting of their biochemical and physiological processes associated with these infections. Intestinal protozoan parasites can affect children in a variety of ways; they cause mal-absorption, rEducced growth, increased risk for protein energy malnutrition, rEducced psychomotor development and anemia. This report addresses *Cryptosporidium, Giardia,* and *Entamoeba* as the main parasitic protozoa of concern among children worldwide.

Keywords: Immune systems; Protozoan parasites; *Cryptosporidium*; *Giardia*; *Entamoeba*

Introduction

Intestinal parasitic infections caused by intestinal helminths and protozoa are among the most common human infections endemic throughout the world especially in tropical and subtropical countries including India. About 3.5 billion persons are infected with intestinal parasites and nearly 450 million suffer from clinical morbidity [3]. The protozoan parasites are the more common cause of gastrointestinal disorders compared to helminthes especially in developing countries. A number of intestinal protozoan parasites are reported in different parts of the world like *Giardia lamblia, Dientamoeba fragilis, Entamoeba histolytica, Blastocystis homini, Isospora belli, Cyclospora cayetanensis* and *Microsporidia.* Among them *Entamoeba, Giardia* and *Cryptosporidium* are the major protozoan parasites of global public health concern. Protozoan parasites being single celled can rapidly multiply inside the body leading to the development of the serious infection. Most of the protozoan infections tend to be asymptomatic. However, the common symptoms associated with it include abdominal discomfort, vomiting and dysentery [4]. When burden of infection is pronounced, it may cause several complications like diarrhea, malaise, bloating, fatigue, epigastric discomfort, malnutrition, mal-absorption, intestinal ulceration, gastroenteritis, weight loss, abscesses, mental retardation and even death. Protozoan infections can also lead to structural and functional abnormalities of small intestines in humans and can be misdiagnosed as appendicitis or other inflammatory diseases of gastrointestinal tract. Children are the primary victims of gastrointestinal protozoan parasites. So the disease control interventions need to be focused towards the pediatric group.

Giardia lamblia

It is a flagellated protozoan parasite of phylum Sarcomastigophora that colonise and reproduce in small intestines of humans, causing disease Giardiasis. *Giardia* is most frequently reported as a cause of diarrhea worldwide. Giardiasis can be responsible for severe malabsorption syndrome causing malabsorption of fat, proteins, folic acid, Vitamin A and vitamin B12 and these nutritional deficiencies in turn may lead to serious organ damage [5]. *Giardia intestinalis* results in stunted growth and poor psychomotor development of children [6]. *Giardia* infection also results in rEducced Hb level [7] and hypoalbuminemia [8,9]. It sometimes infects gall bladder leading to jaundice and colic.

Global burden

Giardia lamblia is the most prevalent protozoan parasite worldwide currently infecting about 200 million people [10]. *G. lamblia* is known to infect 2% to 5% of population in developed countries and 20-40% in developing countries, majority of which are children [5,11,12] (Table 1).

Entamoeba histolytica

It is a protozoan parasite of phylum Sarcomastigophora that colonizes and reproduces in large intestines of humans, causing disease Amoebiasis. The disease may remain restricted to intestinal lumen or invade intestinal lining causing Amoebic dysentery. It not only causes severe diarrhea but can also result in extra intestinal manifestations including rectal bleeding, amoeboma, toxic megacolon, pneumatosis coli, peritonitis and abscesses in the intestine, liver, lung and other organs. *Entamoeba histolytica* is reported to be responsible for deaths of approximately 1,00,000 persons per year, second only to another protozoan infection, malaria [1].

Global burden

Nearly 10% of the world's population is infected with *E. histolytica*, the majority being in developing countries. Most of the infected individuals tend to be asymptomatic while the minority of cases develops clinically apparent disease. *E. histolytica* is known to result in 50-100 million cases of colitis or liver abscesses per year and up to 100,000 deaths annually [13]. Amoebiasis is the third leading cause of death from parasitic diseases world-wide with its greatest impact on people of developing countries (Table 2).

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Country	Area of study	Prevalence (%) reported	Reference
Bangladesh	ICDDRB Hospital, Dhaka	0.37	[13]
Egypt	Damanhur city	14.8	[14]
Ethiopia	North Gondar	41.9	[15]
Ghana	Kumasi	0.2	[16]
Iraq	Abu-Malah and Harer, Basrah	45.16 and 18.7	[17]
Iraq	Kadhmiyah hospital, Baghdad	1.77	[18]
Iraq	Erbil/Kurdistan	13.13	[19]
Iran	Abyek, Qazvin	3.0	[20]
India	Aurangabad	55	[21]
India	Barabanki, UP	19.13	[22]
	Buea, Cameroon	21.4	[23]
India	Chandigarh	7.96	[24]
India	Gujarat	5	[25]
Kenya	Thika District	6.9	[26]
Libya	Sebha Province	3.19	[27]
Malaysia	Inanam sabah	35.48	[28]
Mexico	Coacalco-de Berriozabal	18	[29]
Nepal	Dadeldhura	7.47	[30]
Nepal	Dharan	6.8	[31]
Nigeria	Delta and Edo States	0.51 and 3.1	[32]
Oman	Dhahira	10.5	[33]
	Gaza, Palestine	10.3	[34]
Philippines	Metro Manila	11.6	[35]
Pakistan	Muzaffarabad	11.8	[22]
Pakistan	Quetta	32	[36]
Rwanda	Kigali	3.6	[37]
Thailand	Thai	1.56	[38]
Tajikistan	Western	26.4	[39]

Table 1: Prevalence of Giardia worldwide.

Country	Area of study	Prevalence (%) reported	Reference
Bangladesh	ICDDRB Hospital, Dhaka	1.11	[13]
Cameroon	Buea	24.4	[23]
Egypt	Damanhur city	16.8	[14]
Ethiopia	NorthGondar	27.3	[15]
Ghana	Kumasi	8.5	[16]
Iraq	Sulaimani district	4.05	[41]
Iraq	Abu-Malah, and Harer, Basrah	23.87 and 30.93	[17]
Iraq	Kadhmiyah hospital, Baghdad	9.80	[18]
Iraq	Erbil/Kurdistan	30	[42]
India	Barabanki, UP	28	[22]
India	Bhopal	25.4	[43]
Japan	Hanoi, Vietnam	2	[44]
Kenya	Thika	14.6	[26]
Lesotho	Qacha's Nek	24	[45]
Mexico	Coacalco-de Berriozabal	10	[29]
Malaysia	Inanam sabah,	83.87	[28]
Nigeria	Nigeria	8	[46]
Nepal	Dehran,	6.1	[31]
Philippines	Metro Manila	2.9	[34]
Pakistan	Quetta	29	[35]
Pakistan	Muzaffarabad	5.9	[22]
Rwanda	Kigali	54.5	[37]
Tajkistan	Western Tajkistan	25.9	[39]
Thailand	Thai	0.03	[38]
Uganda	Kampala	2.5	[47]

Table 2: Prevalence of Entamoeba worldwide.

Cryptosporidium parvum

It is a small coccidian protozoan parasite belonging to Phylum Apicomplexa that infects the microvillous region of epithelial cells of the digestive tract in humans. *Cryptosporidium* causes moderate to severe diarrhea in the immunocompetent individuals due to malabsorption and increased secretion. In the immunocompromised individuals, the condition can be prolonged and dangerous. *Cryptosporidium* infection of the intestinal epithelium is associated with villous atrophy, hyperplasia of intestinal crypt cells, and inflammation of the lamina propia. Cryptosporidiosis can sometimes lead to extra-intestinal complications like respiratory cryptosporidiosis, cholecystitis, hepatitis and pancreatitis [48].

Global burden

Global statistics on prevalence of *Cryptosporidium parvum* shows that it infects 2-50% of population worldwide [3]. In Asia and Africa, the infection rate ranges from 5-10% (Table 3).

Intestinal Protozoan Infections in Kashmir Valley

In Kashmir valley the studies conducted so far demonstrate the presence of protozoan parasites *Giardia intestinalis*, and *Cryptosporidum parvum* among chidren. Besides this a number of helminth parasites have also been reported especially *Ascaris lumbricoides, Trichuris trichiura, Enterobius vermicularis Taenia saginata Hymenolepis* and *Ancylostoma* [64,65] (Table 4).

New Approach for Parasite Detection

Diagnosis of intestinal protozoa is made usually by microscopy after staining fecal smears with iodine or any other stain. This technique is being widely used for diagnosis of intestinal protozoa [10,70-74]. However nowadays molecular diagnostic tests are increasingly being used for both clinical as well as research purposes. They involve identification of specific antigen or DNA of parasite in stool or serum samples through Enzyme linked immunoassay (ELISA) [22-24] or direct fluorescent antibody assay [25-27]. These molecular methods besides having high sensitivity for parasite detection help in differentiation of various species of parasite with the help of PCR.

Country	Area of study	Prevalence (%) reported	Reference
Bangladesh	ICDDRB Hospital, Dhaka	4.44	[13]
Ethiopia	Girar Jarso and Dera,	7.3	[49]
Ethiopia	Pawi, northwestern Ethiopia	8.1	[50]
Egypt	Cairo	15.3	[51]
Ghana	Kumasi	8.5	[16]
Ivory coast	Yamoussoukro	36.93	[52]
Iran	Isfahan	4.6	[53]
Iraq	Baghdad	2.3	[54]
India	Dehli	27.4	[55]
India	Uttar Pradesh	33.33	[56]
Jamaica	Kingston	4.3	[57]
Kenya	Kenya	4	[58]
Mexico	Coacalco-de Berriozabal	4	[29]
Netherlands	Netherlands	21.8	[59]
Nigeria	Zaria	4.5	[60]
Palestine	Gaza	16.3	[61]
Philippines.	Philippines.	1.9	[62]
Saudi Arabia	Makkah	4.07	[63]
Uganda	Kampala	1.5	[47]

Table 3: Prevalence of Cryptosporidium worldwide.

Prevalence reported (%)			Area of study	Reference
Giardia	*Entamoeba*	*Cryptosporidium*		
9.20			Srinagar	[66]
12.28			Srinagar	[67]
7			Srinagar	[68]
		36	Srinagar	[69]
73.5	17.35		Jammu	[48]

Table 4: Prevalence of Gastrointestinal Protozoan Parasites in Kashmir.

Control and Prevention

In view of high prevalence of protozoan infection and the morbidity they cause, the measures aimed at their control and prevention need to be strengthened. Steps should be taken to rEducce the infection rate to the levels at which they cease to be of public health significance. The prevention and control of protozoan diseases can be primarily achieved through improvement in personal as well as environmental hygiene [75]. The most effective control can be achieved by involving the community to participate in its own disease control. For this purpose, mass awareness programmes should be conducted to make the people aware about the various infectious agents and their modes of transmission, encourage hygienic practices, recommend use of safe drinking water, avoid defecation in open areas, and prioritize primary health care. Moreover, standard techniques should be used by clinical microbiologists for screening the stool samples to increase the chances of detection of parasites and chemotherapy option should be used for treatment of individuals diagnosed with protozoan infections.

Conclusion

Gastrointestinal disorders caused by various protozoan parasites impose a great burden on human populations in the developing world, particularly among children. The need of the hour is that we should have enough epidemiological information on the prevalence of gastrointestinal protozoan infections and their associated risk factors in different localities which are a prerequisite to develop quality control measures.

References

1. World Health Organization (1997) WHO News and Activities. Bull World Health Organ 75: 291-292.
2. Scrimshaw NS (1994) The consequences of hidden hunger for individuals and societies. Food Nutr Bull 15: 3-24.
3. World Health Organization (2000) Intestinal Parasites.
4. Schunk M, Jelinek T, Wetzel K, Nothdurft HD (2001) Detection of *Giardia lamblia* and *Entamoeba histolytica* in stool samples by two enzyme immunoassays. Eur J Clin Microbiol Infect Dis 20: 389-391.
5. Ali SA, Hill DR (2003) *Giardia intestinalis*. Curr Opin Infect Dis 16: 453-460.
6. Monajemzadeh SM, Monajemzadeh M (2008) Comparison of iron and hematological indices in *Giardia lamblia* infection before and after treatment in 102 children in Ahwaz, Iran. Med Sci Monit 14: CR19-CR23.
7. Neva FA, Brown HW (1994) Basic Clinical Parasitology. 6th edn. Norwalk, Connecticut: Appleton and Lange.
8. Solomons NW (1982) Giardiasis: nutritional implications. Rev Infect Dis 4: 859-869.
9. Ortega YR, Adam RD (1997) Giardia: Overview and update. Clin Infect Dis 25: 545-550.
10. Meyer EA (1985) The epidemiology of giardiasis. Parasitol Today 1: 101-105.
11. Arora DR, Arora B (2005) Medical Parasitology. CBS Publishers and Distributers, New Delhi, India.
12. Wani SA, Ahmad F, Zargar SA, Amin A, Dar ZA, et al. (2010) Intestinal helminthiasis in children of Gurez valley of Jammu and Kashmir State, India. J Glob Infect Dis 2: 91-94.

13. Alam S, Khanum H, Zaman RF, Haque R (2013) Prevalence of Different Protozoan Parasites in Patients Visiting at ICDDR'B Hospital, Dhaka. J. Asiat Soc Bangladesh Sci 39: 117-123.

14. Hegazy AM, Younis NT, Aminou HA, Badr AM (2014) Prevalence of intestinal parasites and its impact on nutritional status among preschool children living in Damanhur City, El Behera Governorate, Egypt. J Egypt Soc Parasitol 44: 517-524.

15. Ayalew A, Debebe T, Worku A (2011) Prevalence and risk factors of intestinal parasites among Delgi school children, North Gondar, Ethiopia. J Parasitol Vector Biol 3: 75-81.

16. Walana W, Tay SCK, Tetteh P, Ziem JB (2014) Prevalence of intestinal protozoan infestation among primary school children in Urban and peri-urban communities in Kumasi, Ghana. Sci J Public Health 2: 52-57.

17. Jarallah HM (2012) Intestinal parasitic infections among rural villages in Basrah marshes regions. Journal of Basrah Researches (Sciences) 38: 40-43.

18. Ibrahim AQ (2012) Prevalence of *Entamoeba histolytica* and *Giardia lamblia* in Children in Kadhmiyah Hospital. The Iraqi J Vet Med 36: 32-36.

19. Hama AA, Rahemo ZIF (2014) Intestinal parasitosis in relation to haemoglobin concentration among primary school children in Erbil province Kurdistan-Iraq. ISJ 1: 96-99.

20. Akhlaghi L, Mafi M, Oormazdi H, Meamar AR, Shirbazou S, et al. (2013) Frequency of intestinal parasitic infections and related factors among primary school children in Abyek township of Qazvin province. Ann Biol Res 4: 22-26.

21. Jain CB, Nahri R (2015) Prevalence of Giardiasis in children from rural areas of Aurangabad, Maharashtra. J Med Chem Drug Discov 758-762.

22. Chaudhary BL, Chandra C (2012) Relationship between Intestinal Parasite Infection and Anaemic Patients. International Journal of Science and Research (IJSR) 3: 020141314.

23. Mbuh JV, Ntonifor HN, Ojong JT (2009) The incidence, intensity and host morbidity of human parasitic protozoan infections in gastrointestinal disorder outpatients in Buea Sub Division, Cameroon. J Infect Dev Ctries 4: 038-043.

24. Sehgal R, Reddy GV, Verweij JJ, SubbaRao AV (2010) Prevalence of intestinal parasitic infections among school children and pregnant women in a low socio-economic area, Chandigarh, North India. RIF 1: 100-103.

25. Jethwa DK, Chaudhri U, Chauhan D (2015) Prevalence of Giardia infection in paediatric age group. Int J Curr Microbiol App Sci 4: 907-911.

26. Ngonjo TW, Kihara JH, Gicheru M, Wanzala P, Njenga SM, et al. (2012) Prevalence and intensity of intestinal parasites in school age children in Thika District, Kenya. Afr J Health Sci 21: 153-160.

27. Bernawi AA, Omar SEM, Kti SE (2013) Prevalence of *Giardia lamblia* in humans visited Central Laboratory of Sebha Province. Int J Innov Res Sci Eng Technol 2: 1-3.

28. Mahsol HH, Mat DZA, Jalil MF, Ahmad AH (2008) Gastrointestinal protozoan parasites amongst school children in Inanam Sabah. Borneo Sci 23: 45-51.

29. Diaz E, Mondragon J, Ramirez E, Bernal R (2003) Epidemiology and control of intestinal parasites with nitazoxanide in children in Mexico. Am J Trop Med Hyg 68: 384-385.

30. Tiwari BR, Chaudhary R, Adhikari N, Jayaswal SK, Poudel TP, et al. (2013) Prevalence of intestinal parasitic infections among school children of Dadeldhura district, Nepal. JHAS 3: 14-16.

31. Sah RB, Bhattarai S, Yadav S, Baral R, Jha N, et al. (2013) A study of prevalence of intestinal parasites and associated risk factors among the school children of Itahari, Eastern Region of Nepal. Trop Parasitol 3: 140-144.

32. Omorodion AO, Nmorsi OPG, Isaac C, Umukoro DO, Akhile AO (2012) Distribution of intestinal parasites among school-age children in Delta and Edo States of Nigeria. PUJ 5: 121-126.

33. Patel PK, Khandekar R (2006) Intestinal parasitic infections among school children of the Dhahira Region of Oman. Saudi Med J 27: 627-632.

34. Al-Hindi AI, El-Kichaoi AY (2015) Occurrence of gastrointestinal parasites among pre-school children, Gaza, Palestine. IUG Journal of Natural Studies 16: 125-130.

35. Baldo ET, Belizario VY, De Leon WU, Kong HH, Chung DI (2004) Infection status of intestinal parasites in children living in residential institutions in Metro Manila, the Philippines. Korean J Parasitol 42: 67-70.

36. Ahsan-ul-Wadood AB, ur Rhman A, Qasim KF (2005) Frequency of intestinal parasite infestation in children hospital quetta. Pakistan J Med Res 44: 87-88.

37. Emile N, Bosco NJ, Karine B (2013) Prevalence of intestinal parasitic infections and associated risk factors among Kigali institute of Educcation students in Kigali, Rwanda. Trop Biomed 30: 718-726.

38. Songserm N, Promthet S, Wiangnon S, Sithithaworn P (2012) Prevalence and co-infection of intestinal parasites among Thai rural residents at high-risk of developing cholangiocarcinoma: a cross-sectional study in a prospective Cohort study. Asian Pac J Cancer Prev 13: 6175-6179.

39. Matthys B, Bobieva M, Karimova G, Mengliboeva Z, Jean-Richard V, et al. (2011) Prevalence and risk factors of helminths and intestinal protozoa infections among children from primary schools in western Tajikistan. Parasit Vectors 4: 195.

40. Ayeh-Kumi PF, Ali IM, Lockhart LA, Gilchrist CA, Petri WA, et al. (2001) *Entamoeba histolytica*: genetic diversity of clinical isolates from Bangladesh as demonstrated by polymorphisms in the serine-rich gene. Exp Parasitol 99: 80-88.

41. Raza HH, Sami RA (2009) Epidemiological study on gastrointestinal parasites among different sexes, occupations, and age groups in Sulaimani district. J Duhok Univ 12: 317-323.

42. Hamad NR, Ramzy IA (2012) Epidemiology of *Entamoeba histolytica* among children in Erbil Province, Kurdistan Region-Iraq. J Res Biol 1: 057-062.

43. Kiran T, Shashwati N, Vishal B, Kumar DA (2014) Intestinal parasitic infections and demographic status of school children in Bhopal region of Central India. IOSR-JPBS 9: 83-87.

44. Uga S, Hoa NTV, Thuan LK, Noda S, Fujimaki Y (2005) Intestinal parasitic infections in schoolchildren in a suburban area of Hanoi, Vietnam. Southeast Asian J Trop Med Public Health 36: 1407-1411.

45. Oguntibeju OO (2003) Parasitic infestation and anaemia: The prevalence in a rural hospital setting. J Indian Acad Clin Med 4: 210-212.

46. Arinola OG, Yaqub AS, Rahamon KS (2012) REducced serum IgE level in Nigerian children with helminthiasis compared with protozoan infection: Implication on hygiene hypothesis. Ann Biol Res 3: 5754-5757.

47. Buzigi E (2015) Prevalence of intestinal parasites, and its association with severe acute malnutrition related diarrhoea. J Biol, Agric Healthcare 5: 81-91.

48. Jad B, Dogra S, Mahajan B (2015) Significant Decrease in Prevalence of Intestinal Parasites among Patients Seeking Treatment in a Tertiary Care Hospital in Jammu: a Changing Trend. Int J Curr Microbiol App Sci 4: 659-664.

49. Wegayehu T, Adamu H, Petros B (2013) Prevalence of *Giardia duodenalis* and *Cryptosporidium* species infections among children and cattle in North Shewa Zone, Ethiopia. BMC Infect Dis 13: 419.

50. Tigabu E, Petros B, Endeshaw T (2010) Prevalence of giardiasis and cryptosporidiosis among children in relation to water sources in selected village of Pawi Special District in Benishangul-Gumuz Region, North-western Ethiopia. Ethiop J Health Develop 24: 208-213.

51. Nevine S, Mona M, Samar S (2012) Detection of *Cryptosporidium* infection among children with diarrhea. New York Sci J 5: 68-76.

52. Koffi M, N'Djeti M, Konan T, Djè Y (2014) Molecular characterization of intestinal protozoan parasites from children facing diarrheal disease and associated risk factors in Yamoussoukro, Côte d'Ivoire. Afr J Environ Sci Technol 8: 178-184.

53. Saneian H, Yaghini O, Yaghini A, Modarresi MR, Soroshnia M (2010) Infection rate of *Cryptosporidium parvum* among diarrheic children in Isfahan. Iran J Pediatr 20: 343-347.

54. Mahmud SA (2009) Protozoal etiology of acute and persistent diarrhea in children in Al-Sowera city in Iraq. Al-Taqani 22: 57-64.

55. Bera P, Das S, Saha R, Ramachandran VG, Shah D (2014) Cryptosporidium in children with diarrhea: A hospital-based study. Ind Paediatr 51: 906-908.

56. Kashyap A, Pal Singh M, Madhu GU (2013) Occurrence of Gastrointestinal Opportunistic Parasites in Immunocompromised Patients in Northern India. J Biol 1: 77-80.

57. Lindo JF, Levy VA, Baum MK, Palmer CJ (1998) Epidemiology of giardiasis and cryptosporidiosis in Jamaica. Am J Trop Med Hyg 59: 717-721.

58. Gatei W, Wamae CN, Mbae C, Waruru A, Mulinge E, et al. (2006) Cryptosporidiosis: prevalence, genotype analysis, and symptoms associated with infections in children in Kenya. Am J Trop Med Hyg 75: 78-82.

59. Ten Hove R, Schuurman T, Kooistra M, Möller L, Van Lieshout L, et al. (2007) Detection of diarrhoea□causing protozoa in general practice patients in The Netherlands by multiplex real□time PCR. Clin Microbiol Infect 13: 1001-1007.

60. Gambo A, Inabo HI, Aminu M (2014) Prevalence of *Cryptosporidium* oocysts among children with Acute Gastroenteritis in Zaria, Nigeria. Bayero J Pure Appl Sci 7: 155-159.

61. Al-Hindi AI, Elmanama AA, Elnabris KJA (2007) Cryptosporidiosis among children attending Al-Nasser pediatric hospital, Gaza, Palestine. Turk J Med Sci 37: 367-372.

62. Natividad FF, Buerano CC, Guzman BB, Seraspe EP, Samentar LP, et al. (2008) Prevalence rates of *Giardia* and *Cryptosporidium* among diarrheic patients in the Philippines. Southeast Asian J. Trop. Med. Public Health 39: 991-999.

63. Al-Harthi SA (2004) Prevalence of intestinal parasites in schoolchildren in Makkah, Saudi Arabia. New Egypt J Med 31: 37-43.

64. Kramar LV, Reznikov EV, Kramar OG (2002) Prevalence if giardiasis in Volgograd city population. Med Parazitol (Mosk) 4: 38-39.

65. Davies AP, Campbell B, Evans MR, Bone A, Roche A, et al. (2009) Asymptomatic carriage of protozoan parasites in children in day care centers in the United Kingdom. Pediatr Infect Dis J 28: 838-840.

66. Mir MA, Raina P, Mattoo TK, Sethi AS (1979) Incidence of giardiasis in Kashmiri children. Indian J Pediatr 46: 358-362.

67. Khan AR, Rasheed M, Koul JA (1994) Prevalence of Giardiasis in Kindergarten school of Urban Kashmir. J Parasitic Dis 26: 30-33.

68. Singh C, Zargar SA, Masoodi I, Shoukat A, Ahmad B (2012) Predictors of intestinal parasitosis in school children of Kashmir: A prospective study. Trop Gastroenterol 31: 105-107.

69. Masarat S, Ahmad F, Chisti M, Hamid S, Sofi BA (2012) Prevalence of *Cryptosporidium* species among HIV positive asymptomatic and symptomatic immigrant population in Kashmir, India. Iranian J Microbiol 4: 35-39.

70. Alzain B, Sharma P (2006) Hemoglobin levels and protozoan parasitic infection in school children of Udaipur city, India. J Al Azhar Univ Gaza (Na Sci) 8: 35-40.

71. Júlio C, Vilares A, Oleastro M, Ferreira I, Gomes S, et al. (2012) Prevalence and risk factors for *Giardia duodenalis* infection among children: a case study in Portugal. Parasit Vectors 5: 22-29.

72. Huma M, Hassan A, Sardana R, Juneed L, Sibal A, et al. (2013) A study on intestinal protozoan parasites in symptomatic pediatric patients. Int J Clin Surg Adv 1: 41-48.

73. Garcia LS, Shimizu RY (1997) Evaluation of nine immunoassay kits (enzyme immunoassay and direct fluorescence) for detection of Giardia lamblia and *Cryptosporidium parvum* in human fecal specimens. J Clin Microbiol 35: 1526-1529.

74. Mank TG, Zaat JOM, Deelder AM, van Eijk J, Polderman AM (1997) Sensitivity of microscopy versus enzyme immunoassay in the laboratory diagnosis of giardiasis. Eur J Clin Microbiol Infect Dis 16: 615-619.

75. Chaudhry ZH, Afzal M, Malik MA (2004) Epidemiological factors affecting prevalence of intestinal parasites in children of Muzaffarabad district. Pakistan J Zool 36: 267-271.

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