Distribution and risk factors associated with intestinal parasite infections among children with gastrointestinal disorders

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Abstract

Aim: Prevalence and risk factors associated with intestinal parasites among children ≤12 years old in Nahavand county western Iran, was the objective of this study.

Background: Intestinal parasites (IPs) are important health problems among most societies.

Methods: This cross sectional study was carried out during 6 months from April to September 2014 in Nahavand County western Iran. Fecal samples were collected from 500 children suffering from gastrointestinal disorders (GIDs) and examined by macroscopy and microscopic (using saline and iodine wet mount, formalin-ether sedimentation, Trichrome and modified Ziehl Neelsen staining) methods. Finally, data was analyzed using Chi-square (Chi2) test and Fisher’s exact test as well as logistic regression.

Results: 21.8% (109/500) of the samples were infected by one or more IPs. The most common parasites were Blastocystis sp. (16.2%), followed by Cryptosporidium spp. (2.6%), Giardia lamblia (1.6%), and Entamoeba coli (1.6%). Prevalence of intestinal parasite infections were significantly associated with age (OR = 2.280; CI 95% = 1.375-3.830; P <0.002), gender (OR = 0.551; CI 95% = 0.348-0.875; P =0.011), contact with domestic animal or soil (OR = 0.492; CI 95% = 0.282-0.860; P =0.013) and seasons (OR = 2.012; CI 95% = 1.254-3.227; P =0.004). There was a significant correlation between IPs with diarrhea (OR = 3.027; CI 95% = 1.712-5.345; P =0.001) and nausea or vomiting (OR = 3.261; CI 95% = 1.281-8.175; P =0.013).

Conclusion: Blastocystis sp. was the most prevalent parasites among children in Nahavand County and Helminthes infection have been dramatically decreased. Our finding showed that gender, age, season and contact with domestic animals or soil polluted are main predictive factors for intestinal parasite infections among children in this region. Moreover, IPs infection among children with gastrointestinal disorders were significantly associated with diarrhea and vomiting or nausea signs.

Key words: Parasitic infection, Distribution and risk factors, Children, Western Iran.

(Please cite as: Kiani H, Haghighi A, Salehi R, Azargashb E. Distribution and risk factors associated with intestinal parasite infections among children with gastrointestinal disorders. Gastroenterol Hepatol Bed Bench 2016; 9(Suppl 1): S80–S87).

Introduction

Intestinal parasitic infections (IPs) can cause acute gastrointestinal disorders (AGIDs), and these organisms result in most common communicable diseases (1-3). Human parasitic infections lead to significant morbidity and mortality among different societies in the world (4,5). Globally, more than 3.5 billion individuals are infected by IPs, and of them 450 million are ill as a result of IPs, the main part of them are being children (6-8). Protozoan infections such as (Ameobiasis, Giardiasis and Cryptosporidiosis) and helminthic infections such as (Ascariasis, Enterobiasis, hookworms, and Trichuriasis) are among the most common intestinal parasitic infection in the worldwide. These organisms are also known as serious public health problems in children and complications such as iron deficiency (anemia), vitamin A deficiency, diarrheal or dysentery, malnutrition, delay growth, physical and mental health problems (7-13). Moreover, IPs can result in serious problems in gastrointestinal disorders patients, immunocompromised patients such as HIV positive, transplanted and hemodialysis patients (2, 14, 15). The incidence and frequency rate of IPs vary in different countries due to environmental condition, geographical factors, location, level of family education, a range of family income, health education, accessibility of
threatened/or unthreatened water, hand washing practices before meal and after the toilet and etc (16-19). The epidemiological data based on the frequency of IPIs is one of the basics for developing appropriate control measures. Previous epidemiological studies in Iran have demonstrated high prevalence of IPIs among different population and have shown that Blastocystis sp., Entamoeba histolytica/E. dispar, Giardia lamblia, Cryptosporidium spp., Enterobius vermicularis and Ascaris lumbricoides are the predominant IPIs (1, 2, 15, 20-25). Surprisingly, in spite of the public health importance of these infections and the potential consequences, there was no enough data about their epidemiology of IPIs among children in western Iran. The aims of this study were to identify the epidemiology and associated risk factors of IPIs in children with gastrointestinal disorders in Nahavand County, western Iran.

Materials and Methods

Study areas & population:
This cross-sectional survey was carried out from April to September 2014 in Nahavand County, Hamadan province, western Iran. Stool samples from 500 children under 12 years old suffered from GIDs who referred to medical centers laboratories were randomly collected. The sample size was calculated using formula: $n = \frac{z^2 \times p(1-p)}{d^2}$ under assumptions as follow: the reference prevalence was considered as 35% (20), a 95% level of confidence and 5% marginal error. The sample size required was 496, but for more accuracy 500 samples were collected.

Questionnaire
The questionnaire was prepared to elicited information on the demographic data (age, gender and location (urban & rural)), acute clinical symptoms (diarrhea and dysentery, abdominal pain, stomach pain, bloating, vomiting & nausea), environmental sanitation and living condition characteristics (season, contact with domestic animals and soil) which will be used to assess the potential risk factors for IPIs. Informed consent was obtained from each attendee prior to the sampling. Certain criteria were applied to enroll children in the study. Inclusion criteria included age ≤ 12 years old with no history of taken anti parasites drugs in two weeks before the test. Exclusion criteria included children suffering from GIDs (diarrhea, dysentery diarrhea, stomach pain, bloating and Nausea or vomiting) disease.

Stool Collection and Processing
From all of the participants a single fresh stool sample were collected from 12 clinical laboratories in Nahavand County. The collected specimens were transported to the parasitological laboratory of Ayatollah Alimoradian hospital, in Nahavand city for the stool analysis process. At first, Information related to patients was recorded on a daily basis in the registered office information and stool samples were observed macroscopically to consistency and the presence of worm, larva, segments, blood, and mucus were recorded. After macroscopic analysis, direct wet mount with normal saline (0.85% NaCl solution) in all of the stool specimens in one side of the slides (for the presence of motile intestinal parasites and trophozoite) was done and lugol’s iodine staining was performed to distinguish cysts of intestinal parasites in other side of the slide. In the next step formalin-ether concentration was prepared and the sediments were stained with iodine, put on a slide and covered with a cover slip to accurate detection of cyst or eggs of intestinal parasites. Moreover, slide smear was prepared in fresh stool and immediately stained with trichrome’s staining to accurate differentiation of intestinal protozoa (Entamoeba, Giardia, Blastocystis sp. and etc). For detection of coccidian parasites (Cryptosporidium spp.), Modified Zeihl- Neelsen staining after concentration technique was done. All of the smears prepared were microscopically observed using 100x, 400x, and 1000 x magnification (26).

Statistical analysis
For statistical analysis the data was exported to Statistical Package for the Social Sciences software version16 (SPSS, Chicago, IL, USA). The proportion percentage was used to describe the characteristics of the participants, including the frequency of IPIs according to age, sex and etc. A Pearson’s Chi-square (Chi2) test and Fisher’s exact test were used for differences in the proportions of IPIs between different variables and odds ratios (OR) and 95% confidence intervals (CI) were used for associations of variables. The t-test was used to compare the mean age. Logistic regression was used to detect risk factors of parasite infection. The P value <0.05 was considered statistically significant.

Ethical clearance
The all the procedures of this study were approved by the Ethics Committee of the Shahid Beheshti University of Medical Science (SBMU), Iran, before the beginning of the study. All study participants were informed about the study procedures and written informed consents were obtained from all of them prior to sample collection.

Results
Sociodemographic characteristic
Out of 500 children with GIDs, 278 boys and 222 girls, aged 22 days-12 years were enrolled in this study. 246 children lived in rural areas and 254 subjects lived in urban area. 149 of 500 participants had frequently contact with domestic animal or soil and 351 child no contact. The proportion of children according to age groups were ≤ 3years (276 patients), 4 – 6 years (135 children) and 7 – 12 years (89 isolates). These specimens were taken during spring (224
Prevalence of intestinal parasites in children

Table 1. Frequency of IPIs and poly-parasitism among children with GIDs in Nahavand County, western Iran (N = 500).

| Type of parasites                  | Mono parasites n (%) | Mixed infections n (%) | Total n (%) |
|-----------------------------------|----------------------|------------------------|-------------|
| Total infected patients           | 97 (19.4)            | 12 (2.4)               | 109 (21.8)  |
| Protozoa                          |                      |                        |             |
| Blastocystis sp.                  | 70 (14)              | 11 (2.2)               | 81 (16.2)   |
| Giardia lamblia                   | 7 (1.4)              | 1 (0.2)                | 8 (1.6)     |
| Cryptosporidium spp.              | 7 (1.4)              | 6 (1.2)                | 13 (2.6)    |
| Entamoeba histolytica/E. dispar   | 0                    | 1 (0.2)                | 1 (0.2)     |
| Entamoeba coli                    | 4 (0.8)              | 4 (0.8)                | 8 (1.6)     |
| Endolimax nana                    | 1 (0.2)              | 1 (0.2)                | 2 (0.4)     |
| Iodamoeba bucheli                 | 1 (0.2)              | 0                      | 1 (0.2)     |
| Entamoeba hartmanni               | 3 (0.6)              | 0                      | 3 (0.6)     |
| Trichomonas hominis               | 2 (0.4)              | 0                      | 2 (0.4)     |
| Chilomastix mesnili               | 1 (0.2)              | 1 (0.2)                | 2 (0.4)     |
| Helminthes                        |                      |                        |             |
| Enterobius vermicularis           | 1 (0.2)              | 0                      | 1 (0.2)     |
| Children infected with protozoa   | 96 (19.2)            | 12 (2.4)               | 108 (21.6)  |
| Children infected with helminthes | 1 (0.2)              | 0                      | 1 (0.2)     |

n: number; * The frequency of intestinal protozoa was significantly higher than intestinal helminthes.

Table 2. Frequency of IPIs by socio-demographic and clinical features in children with GIDs in Nahavand County, western Iran (n = 500).

| Variables                      | Positive | Negative | Total | OR   | CI 95% Lower | CI 95% Uper | P-value |
|--------------------------------|----------|----------|-------|------|--------------|-------------|---------|
| Gender                         |          |          |       |      |              |             | 0.011   |
| Male                           | 71 (25.5)| 207 (74.5)| 278 (100)|      |              |             |         |
| Female                         | 38 (17.1)| 184 (82.9)| 222 (100)| 0.551| 0.348         | 0.873       |         |
| Age (Year)                     |          |          |       |      |              |             | 0.008   |
| ≤3                             | 44 (15.9)| 232 (84.1)| 276 (100)|      |              |             |         |
| 4-6                            | 44 (32.6)| 91 (67.4)| 135 (100)| 2.280| 1.357         | 3.830       | 0.002   |
| 7-12                           | 21 (23.6)| 68 (76.4)| 89 (100)| 1.484| 0.800         | 2.755       | 0.211   |
| Residence                      |          |          |       |      |              |             | 0.606   |
| Urban                          | 51 (20.1)| 203 (79.9)| 254 (100)|      |              |             |         |
| Rural                          | 58 (23.6)| 188 (76.4)| 246 (100)| 1.147| 0.680         | 1.936       |         |
| Contact with domestic animal & soil | 49 (32.9)| 100 (67.1)| 149 (100)|      |              |             | 0.013   |
| Yes                            | 49 (32.9)| 100 (67.1)| 149 (100)|      |              |             |         |
| No                             | 60 (17.1)| 291 (82.9)| 351 (100)| 0.492| 0.282         | 0.860       |         |
| Seasons                        |          |          |       |      |              |             | 0.004   |
| Spring                         | 35 (15.6)| 189 (84.4)| 224 (100)|      |              |             |         |
| Summer                         | 74 (26.8)| 202 (73.2)| 276 (100)| 2.012| 1.254         | 3.227       |         |

n: number; OR: odds ratio; Reference: The top group is considered as baseline. *Chi 2 test and univariate Logistic regression was used.
patients) and summer season (276 patients). According to macroscopic analysis and consistency of stools 272 (54.4%) child have diarrheal stool and frequency of patients with formed, soft, dysenteric diarrhea and hard stools was 145 (29%), 49 (9.8%), 11 (2.2%) and (4.6%) respectively.

**Distribution of Intestinal Parasitic Infections**

According to this study, 21.8 % (109/500) of the children were infected with one or more IPs infection, among them 97 (19.4%) and 12 (2.4%) of individuals had mono and poly parasitism respectively. The most common IPs among children was Blastocystis sp. (81 case/16.2%), followed by Cryptosporidium spp. (13 case/2.6%), Giardia lambia (8 case/1.6%) and Entamoeba coli (8 case/1.6%). The prevalence of other IPs are shown in (Table 1). Among the all children 21.6% (108/500) were infected with protozoan parasites and 0.2% (1/500) were infected with helminthes infection. Frequency of intestinal helminthes among this children was significantly lower than intestinal protozoa ($P < 0.001$).

**Poly Parasitic Infection**

Generally 2.4% (12 patients) were diagnosed with more than one parasite. More frequency of co-infection was Cryptosporidium spp. with Blastocystis sp. in 1 % (5/500 cases) and Entamoeba coli with Blastocystis sp. In 0.8% (4/500). Other co-infection was Entamoeba histolytica/E. dispar with Chilomastix mesnili and Giardia lambia with Blastocystis sp. Triple infection was also observed in one cases Blastocystis hominis with Endolimax nana & Cryptosporidium spp. According to this results high frequency of poly parasitic infections observed in Blastocystis sp. 11 case (2.2%) and Cryptosporidium spp. 6 case (1.2%).

**Risk factors and Clinical features associated with (IPIs)**

Logistic regression by forward method detected the risk factors associated with IPIs among children with GIDs and socio-demographic, environmental and personal hygiene factors evaluated in this study(Table 2). Prevalence of IPIs had significantly different by gender (girls 17.1% was lower than boys 25.5%), (OR= 0.551; CI 95%= 0.348-0.875; $P<0.011$), age groups (children 4-6 years 32.6% higher than other age group) (OR= 2.280; CI 95%= 1.375-3.830; $P<0.002$), children had no contact with domestic animal or soil (17.1%) was lower than children with contact (32.9%) (OR= 0.492; CI 95%= 0.282-0.860; $P<0.013$) and summer
Table 4. Frequency of Cryptosporidium spp., Giardia lamblia and Blastocystis sp. by socio-demographic and clinical features in children with GIDs in Nahavand County, western Iran (n = 500).

| Variables          | Parasites                  | Cryptosporidium spp. | Giardia lamblia | Blastocystis sp. |
|--------------------|-----------------------------|----------------------|------------------|------------------|
|                    | NTotal | Positive (%) | Negative (%) | P-value | Positive (%) | Negative (%) | P-value | Positive (%) | Negative (%) | P-value |
| Age (Year)         |        |             |              |         |             |              |         |             |              |         |
| ≤3                 | 276    | 4 (1.44)    | 272(98.55)   | 0.023*  | 0            | 276 (100)   | 0.001*  | 35 (12.68)  | 241 (87.31)  | 0.009*  |
| 4-6                | 135    | 3 (2.22)    | 132 (97.77)  |          | 5 (3.7)     | 130 (96.3)  |          | 33 (24.44)  | 102 (75.55)  |         |
| 7-12               | 89     | 6 (6.74)    | 83 (93.25)   |          | 3 (3.37)    | 86 (96.62)  |          | 13 (14.6)   | 76 (85.39)   |         |
| Location           |        |             |              |         |             |              |         |             |              |         |
| Rural              | 246    | 11 (4.47)   | 235 (95.52)  | 0.021*  | 6 (2.439)   | 240 (97.56) | 0.170   | 34 (13.82)  | 212 (88.17)  | 0.194   |
| Urban              | 254    | 2 (0.787)   | 252 (99.21)  |          | 2 (0.787)   | 252 (99.21) |          | 47 (18.50)  | 207 (81.49)  |         |
| Contact with domestic animals |        |             |              |          |             |              |         |             |              |         |
| Yes                | 149    | 12 (8.05)   | 137 (91.94)  | 0.001*  | 6 (4.026)   | 143 (95.97) | 0.010*  | 30 (20.13)  | 119 (79.86)  | 0.155   |
| No                 | 351    | 1 (0.285)   | 350 (99.71)  |          | 2 (0.569)   | 349 (99.43) |          | 51 (14.52)  | 300 (85.47)  |         |
| Seasons            |        |             |              |         |             |              |         |             |              |         |
| Spring             | 224    | 2 (0.892)   | 222 (99.1)   | 0.045*  | 1 (0.446)   | 223 (95.55) | 0.080   | 26 (11.6)   | 198 (88.39)  | 0.017*  |
| Summer             | 276    | 11 (3.98)   | 265 (96.01)  |          | 7 (2.53)    | 269 (97.46) |          | 55 (19.92)  | 221 (80.08)  |         |
| Vomiting & nausea  |        |             |              | 0.001*  | 1.000       | 0.506      |         |             |              |         |
| Yes                | 21     | 8 (38)      | 13 (62)      | 0.031*  | 0           | 21 (100)   | 0.725   | 5 (23.8)    | 16          | 0.007*  |
| No                 | 479    | 5 (1.045)   | 474 (98.95)  |          | 8 (1.67)    | 471 (98.33) |          | 75 (15.65)  | 403         |         |
| Diarrhea           |        |             |              |         |             |              |         |             |              |         |
| Yes                | 256    | 11 (4.29)   | 245 (95.7)   | 0.031*  | 5 (1.95)    | 251 (98.04) | 0.725   | 53 (20.7)   | 203 (79.29)  |         |
| No                 | 244    | 2 (0.81)    | 242 (99.18)  |          | 3 (1.22)    | 241 (98.77) |          | 28 (11.47)  | 216 (8.52)   |         |

OR: odds ratio; n: Number; Reference: The top group is considered as baseline; *Chi 2 as well as Fisher exact test are used. Also, univariate Logistic regression was used for age group analysis. *p< 0.05

Seasons (26.8%) higher than spring (15.6%) (OR= 2.012; CI 95% = 1.254-3.227; P<0.004). The frequency rate among rural children (58/23.6%) was slightly (no statistically significant) more than urban residence (51/20.1%). Moreover, monthly prevalence of IPIs in July (32.1%) and August (29.3%) was meaningfully more than April (9.3%), May (16.5%), June (17.6%) and September (16%) (P<0.003). Regarding to clinical symptoms among children with GIDs, frequency of IPIs was significantly correlated with diarrhea (OR= 3.027; CI 95% = 1.712-5.345; P<0.001) and nausea or vomiting (OR= 3.261; CI 95% = 1.281-8.175; P<0.013). Frequency of IPIs in patients with stomach pain were statistically less than patients without stomach pain signs (OR= 0.586; CI 95% = 0.352-0.979; P<0.041). The frequencies of IPIs in other clinical symptoms have not significant differences (Table 3).

Discussion

Epidemiological studies based on frequency of IPIs infection in different society, have primary objective to identify high-
risk groups and formulate appropriate interventions. The present study attempted to assess the accurate data about the prevalence rate, associated risk factors and symptoms results from IPs among children with GIDs.

One hundred and nine patients (21.8%) were infected with IPs. This results is equal to previous study among patients ≥15 years old (24.3%) (21), and is very higher than checkup individuals under 15 years old (9.3%) in Nahavand laboratories (21). 21.6% of children infected by one or more protozoan parasites and only one children infected by helminthes (Enterobius vermicularis) infection. However prevalence of helminthes infection may be increased if cellophane tape, The Baerman techniques and agar plate culture were used (27). However, our study and recently reported studies in different part of Iran (28), Isfahan (29), Hamadan (30), Nahavand (21) represent a dramatic decrease of helminthic infections (Ascariasis, hook worms, Enterobiosis and etc.) and protozoan infections (Ameobiasis, Giardiasis, Cryptosporidiosis and etc.). It may be results from increasing public and individual hygienic, increase awareness of the prevention and control of parasitic infections and access to the safe food and water sources. Also, variations in prevalence of IPs may be due to differences in climatic conditions, environmental hygiene, economic and educational status and study subjects, and previous control efforts.

The most common IPs in our study was Blastocystis sp. with 81 cases (16.2%). It is similar to previous studied in Nahavand County. This study and other study in Tehran and Isfahan show that prevalence of Blastocystis sp. recently increased in Iran (21, 29, 31). But the pathogenicity of Blastocystis sp. is still controversial, some studies suggest that it is a pathogen (32, 33), whereas other studies believe it is a non-pathogen or commensal (33, 34). Recently, discussion on pathogenesis and accurate diagnosis from Blastocystis sp. can be cause of increase reported of this parasite. In our study Blastocystis sp. are related with diarrhea and season. Also previous clinical studies by Tan et al. and Moosavi et al. presented that abdominal pain and diarrhea are two the major signs among Blastocystis-positive patients (31,32). Regardless of Blastocystis sp., Cryptosporidium spp. and Giardia lamblia with the frequency of 13 (2.6%) and 8 (1.6%) respectively was the most common intestinal pathogenic protozoan. Because, staining method for Cryptosporidium spp. and concentration methods are not usually use in laboratories, Modified Zeihl-Neelsen staining after concentration technique specifically in children with GIDs is required in this region and other same regions.

In this study, Cryptosporidium spp., Giardia lamblia and Blastocystis sp. have the most prevalent IPs in children with GIDs. Frequency of Cryptosporidium spp., Giardia lamblia and Blastocystis sp. with Socio-demographic and clinical features in children with GIDs are shown in Table 4. There was significant relationship between cryptosporidiosis by age (p = 0.023), location (p= 0.021), contact with domestic animal and soil polluted by animal feces (p = 0.001), season (p = 0.045), vomiting/ nausea (p = 0.001) and diarrhea (p= 0.031). Significantly different observed among Giardiasis by age (p= 0.001) and contact with domestic animal or soil (p= 0.010). There was significant correlation among Blastocystis sp. by age (p= 0.009), season (p= 0.017) and diarrhea sign (p= 0.007).

Blastocystis sp., Cryptosporidium spp. and Giardia lamblia are zoonotic protozoa that are a great threat to public health and can be transmitted through contaminated water and food. Water and food contaminated with animal wastes and farming practice are important source of transmission. Intestinal parasitic infections, especially Cryptosporidium spp. and Giardia lamblia were significantly associated with contact with domestic animals and soil. Thus it is necessary that animals be kept away from water and food source that are used by human. Animal husbandry and agriculture are common in Nahavand County, in the warm season livestock going to pastures and contamination of water sources and vegetables by livestock fecal can increase pollution. Also frequency of IPs (especially Cryptosporidium spp. and Blastocystis sp.) in warm season (summer) is higher than cold season (spring).

According to age groups significant different was observed among children 6-12 years old by Cryptosporidiosis and giardiasis. It may be due to contact children with polluted source such as vegetable in farms or soil polluted by animal feces during play in soil land and farms especially in rural region or direct contact (person to person) during meal food or etc. together.

In relation to poly parasitism, our results are similar to previous study in Isfahan, Hamadan and previous study in Nahavand County that poly parasitism detected. The observed co-infection could be clarified by the facts that many species of protozoa (Cryptosporidium spp., E. histolytica/E. dispar, Blastocystis sp., Entamoeba coli, Giardia lamblia and etc.) have the same mode of transmission and that hygiene is poor in these areas (21,29,30).

Infection happen by IPs may be consequences such as gastrointestinal disorders (diarrhea or dysentery and etc., anemia, malabsorption, delay growth in children and physical complications, therefore, it was seen as the main health problem (31,35,36). According to clinical signs in our study there was significant correlation among IPs and cryptosporidiosis in GIDs children with diarrhea, and vomiting/ or nausea. Similar to our results various studies in other countries and in severe acute malnutrition related diarrhoea have shown intestinal parasites as risk factors of diarrhoea (37,38). Our results show that there are significant relationship between Blastocystis sp. by diarrhea sign and in previous study in Iranian patients moosavi et al. (Blastocystis sp), keshavarz et al. (Cryptosporidium spp.) and haghighi et al. (Entamoeba histolitica/E. dispar) are significantly
associated with diarrhea (2, 31, 39). Also in turkey the most common complaint related with IPIs was intestinal dysmotility, nausea/vomiting and abdominal distention (8). There were some limitations in our study.

1. Stool samples were collected only once, it is likely that the analysis of three consecutive stool samples could have increased the diagnostic sensitivity.
2. Sample collected was done during two warm season and there is no data about autumn and winter.
3. Due to the lack of facilities and financial funding we could not use all the laboratory available techniques, such as the Baerman technique to find larvae of helminth including Strongyloides stercoralis or cellophane tape to detect Enterobius vermicularis and agar plate culture to find accurate detection of helminthes larva.
4. Also, it is likely that the prevalence of some protozoa such as Entamoeba and Blastocystis sp. could be even higher if culture techniques had been used.

Based on the present study Blastocystis sp. is the prevalent parasites in Nahavand County. Especially pathogenic parasites such as Cryptosporidium spp. and Giardia lamblia among children with GIDs, still are prevalent in western Iran, and helminthes infection have been dramatically decreased during the past decades. Thus, Modified Zehil-Neelsen staining after concentration technique is recommended for Cryptosporidium spp. identification in this area. Also, our finding suggests the risk factors such as gender, season and contact with domestic animals and soil polluted are increase susceptibility of children with IPIs infection. IPIs infection among children with GIDs are associated with diarrhea and vomiting/or nausea in this area and the role of parasites in children’s should be considered. Thus, health interventions to children and prevent children from contact with contaminated resources such as land and livestock waste in this area is necessary.

Acknowledgments

This study was part of the MSc. thesis of Hamed Kiani (Grant. No. 13/1285) and was financially supported by Shahid Beheshti University of Medical Sciences (SBMU). The author’s like to express their gratitude to administrators and stffs of Ayatollah Alimoradian hospital, authorities and personnel of Nahavand Health Care Network and centers, medical laboratories and study participants for their kind cooperation during sample collection.

Conflict of interest

The authors do not have any conflict of interest to report with for this manuscript.

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