Intestinal parasitic infection among mentally handicapped students in the Islamic Republic of Iran

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Abstract

Background: Intestinal parasitic infections are among the most common public health problems in populations with poor hygiene. Consequently, mental retardation increases the risk of infection.

Aims: The aim of this study was to investigate the prevalence of intestinal parasitic infections among mentally disabled young people in Hamadan, western Islamic Republic of Iran.

Methods: This descriptive cross-sectional study was conducted on 318 students in 9 special schools in 2017. Triplicate faecal specimens for each student were subjected to stool analysis using direct wet mount, sedimentation concentration, and permanent staining technique. Chi-squared or Fisher’s exact test were used for statistical analysis.

Results: Out of 318 students, 135 (42.5%, 95% CI: 37.1–47.9) were infected with intestinal parasites. Prevalence rates for females and males were 45.2% (61/135) and 40.4% (74/183) respectively. Protozoan infections (42.5%, 135) were more numerous than helminthiasis (9.6%, 2). Blastocystis hominis (28%, 89) was the most common parasite, followed by Giardia lamblia (9.7%, 31), Entamoeba coli (9.1%, 29) and Trichomonas hominis (6%, 19).

Conclusions: The high prevalence rate of intestinal protozoan infection reflects poor personal hygiene among the students and inappropriate environmental conditions. Therefore, specific public health measures are required for the mentally handicapped students in special schools.

Keywords: Intestinal parasitic infections, mentally disabled persons, students, prevalence, Iran

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Introduction

Parasite infection still strongly influences the lives of humans. Their major impact is seen in developing countries, and especially in vulnerable groups. It is estimated that 3.5 billion people are affected and 450 million are sick worldwide as a result of intestinal parasitic infections (IPIs) (1). The economic burden is significant: they are responsible for a loss of around 35.4 million disability adjusted life years annually. In addition to gastrointestinal symptoms and digestive disorders, IPIs can cause micronutrient deficiency, mental and physical growth retardation and other serious health problems in children (2–4). Nonpathogenic parasites do not cause sickness and some parasitic pathogens may cause asymptomatic or mildly symptomatic infection in immunocompetent hosts. Therefore, these infections have been overlooked in high-risk groups (5).

Intestinal parasites are transmitted via the faecal–oral route, through unsafe drinking water and food and direct contact with contaminated soil and infected people. Low socioeconomic conditions and poor personal hygiene are believed to be the main epidemiological factors in the spread of IPIs in a society (4,6,7). The high incidence of infections among mentally disabled persons is predictable owing to inadequate personal hygiene. Indeed, IPIs are one of the major problems in the management of rehabilitation centres for mentally disabled persons, and mental disability can be considered another risk factor for intestinal infections, especially for parasitic infections (8).

There have been several reports of IPIs in people with disabilities from different parts of the country (9–13), but to our knowledge, there is little information about the infections in people with disabilities in Hamadan province. Therefore, considering the importance of IPIs in school-aged individuals with disabilities, this study was conducted to evaluate the prevalence of IPIs and their epidemiological associations among the students in special schools in Hamadan.

Methods

Patients and study area

Hamadan, the capital city of Hamadan province, is located in the western region of the country, with a population of over 676 105 and an area of 2831 square kilometres. This city lies at 48°32’ E and 34°51’ N and at an altitude of 1850 metres. The region has an average annual temperature of 13.4 °C and average annual precipitation is 308 mm (data from the Statistical Centre of Iran: https://www.amar.org.ir).
This cross-sectional study was conducted in 9 special schools for students with intellectual disability, including primary and high schools, from January to July 2017 in Hamadan. All of the students, 530 individuals, were enrolled in the study.

**Ethical considerations**
Before the start of the study, informed consent was obtained from the students’ parents. This study was approved by the research ethics committee of the Hamadan University of Medical Sciences (Ref. Number: 16.35.1.5168).

**Sample collection and examination**
Interviews were conducted by trained teachers. Parents answered sociodemographic questions regarding age, sex, parents’ education, residence status, and method of washing vegetables. Then, stool specimens were collected every other day (total 3 specimens) because of the intermittent nature of parasite shedding \(^1\). The stool specimens were transferred to the parasitology research laboratory of Hamadan University of Medical Sciences and tested by complete ova and parasite examination \(^1\). After macroscopic examination, the samples were subjected to microscopic examination: direct wet smear (saline and Lugol’s iodine preparation), formalin–ethyl acetate concentration, and trichrome permanent stained smear \(^1\). Those students found to be infected were referred to health centres for treatment.

**Statistical analysis**
Statistical data analysis was performed using SPSS, version 16, and chi-squared \( (\chi^2) \) or Fisher’s exact tests. P-value < 0.05 was considered statistically significant.

**Results**
Of the 530 students in total, 318 remained in the study; the others were excluded because of incomplete information or improper sample collection. The age of the participants ranged from 7 to 18 years; 183 (57.5%) were males and 135 (42.5%) were females.

We found that 135 of the students (42.5%, 95% CI: 37.1–47.9%) were parasitized by intestinal protozoa and helminths, prevalence 42.5% \((n = 135)\) and 0.6% \((n = 2)\) respectively. Sociodemographic characteristics of the

| Demographic characteristics | Total No. (%) | Infected No. (%) | Uninfected No. (%) | P-value |
|-----------------------------|---------------|-----------------|-------------------|---------|
| **Age (years)**             |               |                 |                   |         |
| 7–12                        | 190 (100)     | 67 (35.3)       | 123 (64.7)        | 0.002   |
| 13–18                       | 128 (100)     | 68 (53.1)       | 60 (46.9)         |         |
| **Sex**                     |               |                 |                   | 0.397   |
| Male                        | 183 (100)     | 74 (40.4)       | 109 (59.6)        |         |
| Female                      | 135 (100)     | 61 (45.2)       | 74 (54.8)         |         |
| **Mother’s education**      |               |                 |                   | 0.292   |
| Illiterate                  | 60 (100)      | 32 (53.3)       | 28 (46.6)         |         |
| Primary school              | 80 (100)      | 37 (46.3)       | 43 (53.7)         |         |
| Junior high school          | 57 (100)      | 24 (42.1)       | 33 (57.9)         |         |
| Senior high school          | 26 (100)      | 8 (30.8)        | 18 (69.2)         |         |
| University                  | 10 (100)      | 3 (30)          | 7 (70)            |         |
| **Father’s education**      |               |                 |                   | 0.027   |
| Illiterate                  | 54 (100)      | 33 (61.1)       | 21 (38.9)         |         |
| Primary school              | 54 (100)      | 27 (50)         | 27 (50)           |         |
| Junior high school          | 65 (100)      | 25 (38.5)       | 40 (61.5)         |         |
| Senior high school          | 37 (100)      | 11 (29.7)       | 26 (70.3)         |         |
| University                  | 20 (100)      | 8 (40)          | 12 (60)           |         |
| **Residence**               |               |                 |                   | 0.21    |
| Urban                       | 203 (100)     | 87 (42.8)       | 116 (57.1)        |         |
| Rural                       | 29 (100)      | 16 (55.2)       | 13 (44.8)         |         |
| **Method of washing vegetables** |        |                 |                   | 0.002   |
| Water                       | 70 (100)      | 43 (61.4)       | 27 (38.6)         |         |
| Detergent solution          | 109 (100)     | 45 (41.3)       | 64 (58.7)         |         |
| Disinfectant solution       | 52 (100)      | 16 (30.8)       | 36 (69.2)         |         |

\(^{a}\)Data analysis was conducted on 232 participants who had fully answered the questions.
Two decades ago, soil-transmitted helminth infections were one of the most common IPIs in the general population, particularly helminthiasis (19). Development of health promotion and education programmes in this region has led to a reduction in IPIs, especially in children and adolescent students with intellectual disabilities in Hamadan. Prevalence was 42.5% (95% confidence interval 37.1–47.9), which is higher than findings reported during the past decade from other parts of the country, including Urmia (20.4%) in the north west, Mazandaran province (26.2%) and Rasht (29.5%) in the north, and Ahvaz (33%) in the south (9–12). However, it is lower than the 48.5% prevalence described in the intellectually disabled residents of a rehabilitation centre in Bandar Abbas, another area in southern Islamic Republic of Iran (13).

The difference between our findings and those of previous studies may be attributable to sample size, sampling strategy, method of stool examination, geographical area or study population. In other parts of the world there are relatively few estimates of the prevalence of IPIs in the mentally disabled population; examples include Egypt 43.5%, Korea 35.7% and Thailand 38.46% (16–18).

In our study, protozoal infections were common among the participants and intestinal helminthiasis was rare although enterobiasis was not investigated by the adhesive selotape anal swab method. This finding is in accordance with the results of studies conducted in the north of the country (10,11). The human microcoeliasis detected in our study is a spurious infection and must be ignored due to the consumption of raw liver from animals infected with D. dendriticum. Two decades ago, soil-transmitted helminth infections were one of the most common IPIs in the general population in Hamadan: prevalence of ascariasis was 19% in 2001 (19). Development of health promotion and education programmes in this region has led to a reduction in IPIs, particularly helminthiasis (20).

A high frequency of multiple parasitic infections was another important finding: 12.3% were infected with ≥ 2 parasite species. In our study, polyparasitism was significantly higher than in the other studies conducted in the Islamic Republic of Iran and in contrast with those studies, triple and quadruple infections were observed.

The prevalence rates for parasites are listed in Table 2. Mono- and polyparasitism rates were 30.2% (96) and 12.3% (39), respectively. Thirty-three of the students (10.4%) harboured pathogenic intestinal parasites and 102 (32.1%) were infected with nonpathogenic parasites. Blastocystis hominis was the most common intestinal parasite with an overall prevalence of 28% (89 cases) compared with 0.3% (1 case) for both Ascaris lumbricoides and Dicrocoelium dendriticum.

### Discussion

Intestinal parasitic infections constitute a major public health concern globally. The infections are often associated with certain socioeconomic factors such as poverty, high population density, lack of access to health facilities and poor personal hygiene. Epidemiological survey of IPIs is necessary for health promotion interventions in targeted populations. In our study, we investigated the prevalence of IPIs and the predisposing factors among children and adolescent students with intellectual disability in Hamadan. Prevalence was 42.5% (95% confidence interval 37.1–47.9), which is higher than findings reported during the past decade from other parts of the country, including Urmia (20.4%) in the north west, Mazandaran province (26.2%) and Rasht (29.5%) in the north, and Ahvaz (33%) in the south (9–12). However, it is lower than the 48.5% prevalence described in the intellectually disabled residents of a rehabilitation centre in Bandar Abbas, another area in southern Islamic Republic of Iran (13).

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### Table 2: Prevalence of intestinal parasites, according to parasite species and multiplicity of infection, among 318 mentally handicapped students in Hamadan, Islamic Republic of Iran, 2017

| Multiplicity of infection | Parasite species (cyst, trophozoite & ova) | No. (%) |
|---------------------------|-------------------------------------------|---------|
| **Single**                |                                           |         |
|                           | Blastocystis hominis                       | 96 (30.2)|
|                           | Giardia lamblia                            | 55 (17.3)|
|                           | Trichomonas hominis                        | 20 (6.3) |
|                           | Entamoeba coli                             | 9 (2.8)  |
|                           | Iodamoeba butschlii                        | 7 (2.2)  |
|                           | Dientamoeba fragilis                       | 3 (0.9)  |
|                           | Endolimax nana                             | 1 (0.3)  |
| **Double**                |                                           | 25 (7.9) |
|                           | Blastocystis hominis + Entamoeba coli      | 7 (2.2)  |
|                           | Blastocystis hominis + Trichomonas hominis | 6 (1.9)  |
|                           | Blastocystis hominis + Giardia lamblia     | 5 (1.6)  |
|                           | Blastocystis hominis + Iodamoeba butschlii | 3 (0.9)  |
|                           | Blastocystis hominis + Dientamoeba fragilis| 1 (0.3)  |
|                           | Entamoeba coli + Giardia lamblia           | 1 (0.3)  |
|                           | Entamoeba coli + Iodamoeba butschlii       | 1 (0.3)  |
|                           | Entamoeba coli + Endolimax nana            | 1 (0.3)  |
| **Triple**                |                                           | 10 (3.1) |
|                           | Giardia lamblia + Entamoeba coli + Endolimax nana | 1 (0.3) |
|                           | Giardia lamblia + Blastocystis hominis + Iodamoeba butschlii | 1 (0.3) |
|                           | Giardia lamblia + Blastocystis hominis + Entamoeba coli | 1 (0.3) |
|                           | Giardia lamblia + Blastocystis hominis + Dicrocoelium dendriticum | 1 (0.3) |
|                           | Blastocystis hominis + Entamoeba coli + Trichomonas hominis | 3 (0.9) |
|                           | Blastocystis hominis + Entamoeba coli + Chilomastix mesnili | 1 (0.3) |
|                           | Blastocystis hominis + Entamoeba coli + Iodamoeba butschlii | 1 (0.3) |
|                           | Blastocystis hominis + Entamoeba coli + Ascaris lumbricoides | 1 (0.3) |
| **Quadruple**             |                                           | 4 (1.3)  |
|                           | Entamoeba coli + Blastocystis hominis + Iodamoeba butschlii + Giardia lamblia | 1 (0.3) |
|                           | Entamoeba coli + Blastocystis hominis + Iodamoeba butschlii + Endolimax nana | 1 (0.3) |
|                           | Entamoeba coli + Blastocystis hominis + Iodamoeba butschlii + Trichomonas hominis | 1 (0.3) |
|                           | Entamoeba coli + Endolimax nana + Iodamoeba butschlii + Entamoeba hartmanni | 1 (0.3) |

participants are presented in Table 1. The associations between IPIs and age, father’s education, method of washing vegetables were statistically significant.
Les infections à protozoaires (42,5 %, 135) ont été plus nombreuses que les helminthiases (0,6 %, 2).

Méthodes :
La présente étude a été menée auprès de 318 élèves de neuf écoles spéciales en 2017. Des échantillons de selles en triplicata pour chaque élève ont été soumis à analyse en utilisant la technique de montage humide direct, de concentration par sédimentation et de coloration permanente. Le test du khi carré et le test exact de Fisher ont été utilisés pour l’analyse statistique.

Résultats : Sur 318 élèves, 135 (42,5 %, IC 95 % : 37,1 à 47,9) étaient infectés par des parasites intestinaux. Les taux de prévalence chez les filles et les garçons étaient de 45,2 % (61/135) et 40,4 % (74/183) respectivement. Les infections à protozoaires (42,5 %, 135) ont été plus nombreuses que les helmintiases (0,6 %, 2). Blastocystis hominis (28 %, 89) était le parasite le plus fréquent, suivi par Giardia lamblia (97 %, 31), Entamoeba coli (91 %, 29) et Trichomonas hominis (6 %, 19).
Conclusions: Le taux élevé de prévalence des infections intestinales à protozoaires reflète le manque d’hygiène personnelle des étudiants et des conditions environnementales inappropriées. Par conséquent, des mesures de santé publique spécifiques sont nécessaires pour les étudiants atteints d’un handicap mental dans les écoles spéciales.

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