

Prevalence of Intestinal Parasitic Infections Among Primary School Children in Bushehr, Iran

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Abstract

Background: Due to their weak immune systems, contact with soil, and failure to comply with hygiene principles, the prevalence of intestinal parasitic infection is high among children.

Objectives: This study was conducted to determine the prevalence of intestinal parasitic infection and the effects of various factors among elementary school children in Bushehr, Iran.

Methods: Following coordination with the education office, schools were randomly selected from different areas, and fecal samples were collected from 203 males and females students at different education levels. The samples were examined using the formalin-ether sedimentation technique. The data were collected via questionnaires and analyzed using SPSS 18.0 and the Chi-squared test.

Results: Approximately 25.1% of the children were infected with at least one type of intestinal parasite, and 5.9% of them were infected with more than one species. The highest prevalence was apparent in children at education levels 4 and 5. There was no significant relationship between infection and parents' education and some clinical symptoms, such as abdominal pain, loss of appetite, and nausea, but there was a significant relationship with the number of family members.

Conclusions: The prevalence of intestinal parasitic infections was relatively high among the schoolchildren in this study. Since these parasites can cause anemia and dysfunctional nutrient absorption, growth, and learning among children, it is suggested that training courses be held for parents and that basic steps be taken to improve the level of hygiene in the region to prevent the transmission of these parasites.

Keywords: Prevalence, Intestinal Parasites, Primary School Children, Bushehr, Iran

1. Background

Despite the rapid and significant developments in health care and health promotion in most regions of the world, intestinal parasitic infections remain one of the most important health problems affecting the economy, especially in developing countries. According to the world health organization (WHO), nearly two-thirds of the world's population, which is the equivalent of 3.5 billion people, is infected with a variety of parasites, and annually, 450 million of these people show clinical symptoms (1). Moreover, about 16 million of the total deaths each year that occur in developing countries are related to parasitic infections (2).

Notably, infections caused by intestinal parasitic agents are very significant and have a worldwide distribution (3). In some cases, the symptoms of these infections can be very serious and cause complications such as intestinal obstruction, appendicitis, cholecystitis, myocarditis, genital infection, and extra-intestinal

abscess.

Various studies have estimated that there is a 2.4% - 67.5% prevalence of intestinal parasites in people of different ages (4). Due to the low level of their immune system evolution, contact with soil and other contaminated materials, and non-compliance with health standards, the prevalence of intestinal parasites is high among children, making them the most vulnerable to infection (5). Indeed, millions of children around the world suffer from complications as a result of intestinal parasites annually. These parasites can cause malnutrition and gastrointestinal disturbances, such as nausea, vomiting, and dysentery, and subsequently lead to weakness, anemia, avitaminosis, loss of immune defense, and reduced physical growth (6). Considering that most of these parasitic transmissions occur via infectious eggs or cysts, these infections are most common in communities that have high population densities, such as daycare centers, barracks, and primary schools (2). Accordingly, the observance of good hygiene in primary schools and children's general activities plays a very im-

portant role in the development of societies. The WHO has therefore prioritized investigations into specific problems, such as malnutrition, the use of tobacco, and intestinal parasitic infections, and proposed that these issues be evaluated by experts with the aim of planning and implementing prevention and control strategies (6).

The prevalence of parasitic infections in various parts of Iran is very different and depends on climatic conditions, geographical location, population density, and a variety of cultural, economic, social, and other factors, such as the disposal of garbage and human sewage. Notwithstanding, it is generally considered one of the most important health issues in all the regions of the country (7-10). A review of previous studies carried out in different parts of Iran identified a range of statistics indicating the prevalence of parasitic infections. For instance, in a study of primary school students in Hamedan, the prevalence was 73.3% (11). Other studies noted a prevalence of 60.9%, 53.6%, 50%, and 59% in Isfahan, Urmia, Lavasanat, and Yasuj, respectively (3, 7). The prevalence was also recorded as 42.5% in schoolchildren in Urmia in the BarandozChay region in 2011 (12).

The first steps to control and prevent intestinal parasitic infections comprise conducting epidemiological studies, identifying pathogenic agents, and determining the number of affected people in different populations, especially school-aged children who are most vulnerable to infection yet also vital to the future of their country. These findings can be used for to determine the appropriate health measures and plans needed to treat patients and prevent further contamination among children.

2. Objectives

Bushehr is located in southwestern Iran. Due to its proximity to the equator and the Persian Gulf, it is often hot and humid, and thus ideal for the spread of parasitic infections and intestinal parasites in particular. We therefore decided to determine the prevalence of intestinal parasites among primary school students in Bushehr and the factors that could increase the risk of infection, including gender, number of siblings, and parents' education, among others.

3. Methods

We first obtained approval for this cross-sectional study from the ethics committee of Bushehr University of Medical Sciences. The sample size was calculated as a prevalence of 25%, $d = 0.06$, at a confidence level of 95%. Accordingly, 203 children who were studying in the first to

fifth grades at 12 primary schools located in the urban areas of Bushehr city (the capital of Bushehr province) from September 2011 to May 2012 were enrolled for this study. After coordinating and obtaining authorization to enter the schools, the students were selected via randomized cluster sampling. A questionnaire was subsequently designed to collect information regarding the children's demographics and various other variables related to parasitic infections, such as age, sex, and parents' literacy status. Meetings were organized with the parents so that parental consent could be obtained for the study and the questionnaires could be completed. Two stool sample containers were given to the parents, and based on a scheduled plan; we liaised with the schools to collect the samples. These were then kept in standard conditions before being transferred to the parasitology research laboratory at Bushehr University of Medical Sciences. The samples were then tested using the direct smear technique (wet mount and Lugol's iodine). To further enhance the accuracy of the test, the formalin-ether concentration method was used according to the protocol recommended by the WHO.

Finally, the demographic information, completed questionnaires, and test results were analyzed using SPSS software version 18 (SPSS Inc., Chicago, IL). A $P < 0.05$ was considered statistically significant.

4. Results

The results showed that 51 students (25.1%) were infected with at least one or more intestinal parasites, and of these, 5.9% had more than one type of parasite. Blastocystis hominis was the most common source of parasitic infection (7.4%). Table 1 details the results based on the type of parasite.

Table 1. The Distribution of Intestinal Parasites Among the Primary School Children in Bushehr

| Parasite | Frequency (%) |
|-----------------------------|---------------|
| <i>Blastocystis hominis</i> | 15 (7.4) |
| <i>Giardia lamblia</i> | 12 (5.9) |
| <i>Entamoeba coli</i> | 7 (3.4) |
| <i>Endolimax nana</i> | 5 (2.5) |
| Mixed infection | 12 (5.9) |
| No infection | 152 (74.9) |
| Total | 203 (100) |

The children were divided into five categories based on their education level. The highest rates of infection were found in the children at educational levels 4 and 5. Our

statistical analysis showed that there was no significant relationship between education level and the prevalence of intestinal parasites (Table 2).

The incidence of intestinal parasites was slightly higher among the girls than the boys; 10.3% of the boys were infected with one or more parasites, and the rate among the girls was 14.8%. However, this difference was not statistically significant (Table 3).

Other variables were also analyzed in this study, namely the number of siblings, the mother's education level, as well as some clinical symptoms, such as abdominal pain, loss of appetite, nausea, and vomiting. The prevalence of abdominal pain in the children infected with intestinal parasites was higher than in the children without infection although this difference was not statistically significant. Our statistical analysis showed a significant relationship between the number of siblings and the prevalence of intestinal parasites ($P < 0.03$): nearly half of the children in large families were infected with various types of parasites (Table 4).

5. Discussion

Children are the most vulnerable population group in terms of infection by different kinds of parasites. Due to their low levels of immunity, contact with soil and other contaminated materials, and lack of understanding of the importance of health standards, there is generally a high percentage of intestinal parasitic infections among children (5). Intestinal parasites can disrupt nutrient absorption and cause malnutrition, gastrointestinal disturbances such as nausea, vomiting, avitaminosis, loss of immune defense, reduced physical growth, dysentery, and the associated weakness, anemia, and iron deficiency (6). Notably, the direct and simple transmission of some intestinal parasites from infected to non-infected individuals is highly prevalent in communities with high population densities (2). Accordingly, the highest levels of infection in communities may be related to schoolchildren (1). Considering that children are intrinsically growing, the observance of good hygiene in primary schools and children's general activities plays a very important role in the development of societies.

In the present study, the prevalence of intestinal parasites in the schoolchildren of the port city of Bushehr was determined to be approximately 25.1%. Similar studies conducted in different parts of the world have achieved different results. For instance, in a study of schoolchildren in Urmia in the BarandozChay region, the prevalence rate of parasitic infections was reportedly 42.5% (12). Similar studies in Semnan, Kerman, Aliabad-e Katul, north of Tehran, and Zanzan have declared the prevalence to be 30%,

41.2%, 13.7%, 22.4%, and 22.5%, respectively (6, 9). In two separate studies of school-age children in Nigeria and Spain, the prevalence was found to be 29.7% and 27.2%, respectively (13, 14). Additionally, a study in Turkey determined the prevalence of intestinal parasites in elementary school children to be 31.8% (15). In contrast, far higher prevalence rates have been found in other studies. For school pupils studying in Isfahan, Arak, Hamedan, and Nepal, for example, the prevalence rates were 60.9%, 63.5%, 71.3%, and 66.6%, respectively, which were significantly higher than those found in other studies (9, 16). This difference in prevalence can be caused by several factors, such as the time of the research, geographical location, and ecological zone, as well as economic, social, and cultural factors (9). High prevalence in some areas, in addition to increasing the risk of transmission of these parasites to other people, can indicate that the level of these regions is low (17).

In this study there was no significant correlation between the prevalence of intestinal parasites and the gender of the children studied, although the prevalence was higher among the girls than the boys. This finding is similar to the results of some of the research done in this field (1, 3, 5, 6, 9, 18, 19). In a study of students in the Shahriar region, the researcher stated that girls have greater contact with raw vegetables, which could be one of the reasons for this difference (18). In some studies however, the rate of infection in boys has been significantly higher than that in female students (7, 16, 20). The reasons for this difference could be the greater contact boys have with the sources of contaminants such as soil, while higher respect for the principles of personal hygiene and less play in soil leads to lower contamination levels in girls (1, 6).

Infection with intestinal parasites has been reported across all age groups, but many reports indicate that it is more common in school-age children than other age groups, so that the most severe infections in society may be found in schoolchildren (1). In this study, the highest rates of infection were found in children at education levels 4 and 5. An explanation for this finding could be that the chance of exposure to contaminated sources increases as children get older. Our statistical analysis showed no significant relationship between the education level of the students and the prevalence of intestinal parasites, which according to the homogeneity of the population, seems to be normal.

Recent reports have indicated a higher level of protozoan infection in comparison with infection with helminths in different populations. In a study of primary school children in Semnan province, neither hookworm, whipworm, *Taenia*, *Strongyloides*, nor *Ascaris* were found in the fecal samples. The reasons that the researcher gave for this included unsuitable conditions for the transfer

Table 2. The Distribution of Intestinal Parasites Among the Primary School Children in Bushehr by Education Level

| Level | Results | | | P Value |
|--------------|------------------|------------------|---------------|---------|
| | Negative No. (%) | Positive No. (%) | Total No. (%) | |
| 1 | 21 (10.3) | 5 (2.5) | 26 (12.8) | 0.11 |
| 2 | 27 (13.3) | 3 (1.5) | 30 (14.8) | |
| 3 | 31 (15.3) | 10 (4.9) | 41 (20.2) | |
| 4 | 39 (19.2) | 14 (6.9) | 53 (26.1) | |
| 5 | 34 (16.7) | 19 (9.4) | 53 (26.1) | |
| Total | 152 (74.9) | 51 (25.1) | 203 (100) | |

Table 3. The Distribution of Intestinal Parasites Among the Primary School Children in Bushehr by Sex

| Sex | Results | | | P Value |
|--------------|------------------|------------------|---------------|---------|
| | Negative No. (%) | Positive No. (%) | Total No. (%) | |
| Male | 79 (38.9) | 21 (10.3) | 100 (49.3) | 0.12 |
| Female | 73 (36) | 30 (14.8) | 103 (50.7) | |
| Total | 152 (74.9) | 51 (25.1) | 203 (100) | |

Table 4. Various Factors Affecting the Distribution of Intestinal Parasites among the Primary School Children in Bushehr

| Variable | Prevalence | | P Value |
|---------------------------------|------------------|------------------|---------|
| | Negative No. (%) | Positive No. (%) | |
| Number of siblings | | | 0.01 |
| 1 | 27 (13.3) | 1 (0.5) | 0.48 |
| 2 | 107 (52.7) | 35 (17.2) | |
| 3 | 18 (8.9) | 15 (7.4) | |
| Mother's literacy status | | | 0.48 |
| Illiterate | 77 (37.9) | 25 (12.3) | 0.13 |
| Literate | 75 (36.9) | 26 (12.8) | |
| Abdominal pain | | | 0.13 |
| Yes | 74 (36.5) | 30 (14.8) | 0.17 |
| No | 78 (38.4) | 21 (10.3) | |
| Loss of appetite | | | 0.17 |
| No | 44 (21.7) | 19 (9.4) | 0.24 |
| Yes | 108 (53.2) | 32 (15.8) | |
| Nausea | | | 0.24 |
| Yes | 30 (14.8) | 13 (6.4) | 0.17 |
| No | 122 (60.1) | 38 (18.7) | |

of soil-borne helminthes due to the health-promoting culture of the society, the prevention of the illegal slaughter of livestock, as well as health and control measures implemented by health centers and others (6). Conversely,

in this study, the prevalence of intestinal protozoa was remarkable. Undoubtedly, health strategies, such as educational programs and avoiding the use of human fertilizers in agriculture, may help reduce the level of

infection with these agents (21).

As an opportunistic pathogen, after *Entamoeba coli*, *Blastocystis hominis* is the most common intestinal parasite globally. Notwithstanding, in studies of immunocompromised and hemodialysis patients, it has been reported as the most prevalent parasite (22, 23). Similarly, in this study, *Blastocystis hominis* was the most prevalent parasite. Although this protozoon is considered an opportunistic parasite and may cause symptoms in immunocompromised patients, the high prevalence of the parasite also represents poor hygiene practices, particularly in terms of contaminated food and drinking water, which should be considered in treatment and prevention strategies (20).

The second most common parasite in this study was *Giardia lamblia*, which is a pathogenic protozoon with a prevalence of 5.9%. This should ring alarm bells for health authorities working in tropical and high-density areas such as schools that more attention to hygiene practices is needed.

The relationship between parasitic infection and variables such as abdominal pain, anorexia, and the literacy status of mothers were also addressed in our study. Although there was no significant relationship between infection and these variables, a notable difference was observed between the prevalence of infection in children whose mothers were literate and those with illiterate mothers.

Our statistical analysis showed that there is a significant relationship between the infection rate and the number of children in a family ($P < 0.03$). This result is consistent with a number of previous studies (2, 3, 24). A similar study found a significant association between infection rate and the number of family members. The author noted as a causative factor that an increase in population density can increase the possibility of intestinal parasite transmission (2).

5.1. Conclusion

We found that 25.1% of the children in our study had at least one intestinal parasite, which is a significant statistic. Given the high prevalence of infection in childhood, particularly at education levels 4 and 5, as well as the adverse effects infection has on children's physical and mental growth, which can lead them to fall behind at school, it is recommended that tests be conducted periodically and training programs for school staff and the parents of students be implemented as a matter of priority.

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