



## Pathogenic intestinal parasites in infants in Al-Diwanyah City: an epidemiological and diagnostic investigation

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### Abstract

**Background:** An area of concern for children is intestinal parasitic infections from their environment where it is not stable. **Objective:** This research aimed to assess the occurrence of intestinal parasites among children from Al-Diwaniyah city residential districts and to find out the relationship between environmental variables, such as temperature, humidity, sunlight, and rainfall, and the transmission patterns of those parasites. **Methodology:** A total number of 2145 patients were observed in the study from August 2025 until January 2026. The total incidence of infection was 30.63%, and the study had evidence of a high level of overall endemicity. The data also showed there were a variety of disease types; for example, parasitic disease occurred at the highest rate, with 417 episodes (63.5%), indicating there's substantial soil contamination. The investigator found *Entamoeba histolytica* in 61 of those 200 cases of contaminated drinking water, or approximately 30.4%. *Giardia lamblia* was found in 40 of the 200 cases of giardiasis (6.1%). *Giardia lamblia* spreads by means of its cysts found in water. **Results:** Males represent 52.97% of the entire population (348 cases) and females 47.03% (309 cases), creating nearly equal representation between males and females concerning the gender distribution of the population. Consequently, all the individuals in this population were exposed to contaminated food and water. In terms of the age variable, children aged 1 through 5 years had the highest rate of disease occurrence/illness burden (55.56%), followed by children aged 5 years (31.66%). The rapid increase in disease occurrence in early childhood, before 5 years, has been attributed to the absence of naturally developed immunity, basic "hand-to-mouth habits" due to developmental stages, and behaviors associated with playing in unclean dirt. The results of the research indicate a relatively equal number of males and females, with 47.03% (309 cases) of patients being female, and 52.97% (348 cases) being male. This means that all individuals in the sample have had one or more opportunities to come into contact with contaminated sources (food or water). **Conclusion:** Children aged one to five appeared to account for the highest percentage of infected patients based on their age, with children aged five accounting for the highest number of infected children. The increases in the number of children under five years old who are infected were attributed to activities such as playing in contaminated soil, hand-to-mouth pathways, and an undeveloped immune system. [Bangladesh Journal of Infectious Diseases, June 2026;13(1):348-353]

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### Introduction

Intestinal parasites are thought to be the most prevalent health issue worldwide and are among the

most frequent parasites that infect people. Depending on the species, a number of factors contribute to the spread of these parasites, including

intestinal helminths. Certain parasites enter the mouth and are spread by hands contaminated with eggs, cyst stages, or larval stages the infectious stage of these parasites or by consuming contaminated food or drink. Furthermore, some parasites, such *Giardia* and pinworms (*Enterobius vermicularis*), can spread from person to person via the fecal-oral route<sup>1</sup>. The Infestation rate was about 52.8% for both *Ascaris lumbricoides* and *Giardia lamblia*, which were the most commonly found intestinal parasites among children between one and five years old in the urban slum areas of Karachi, Pakistan, according to Mehraj et al<sup>2</sup>. Many studies have investigated the prevalence of intestinal parasite infections in Iraq. Kadhim<sup>3</sup> found a prevalence of 53.0% among elementary school students from various locations in Baghdad, including Al-Mansour, Al-Shula and Al-Yusufiyah. The predominant protozoan was *Entamoeba coli* (25.0%), followed by *Giardia lamblia* (15.0%) and *Entamoeba histolytica* (21.1%). Other studies have also looked at the transmission of these parasites to young children in Al-Diwaniyah Province. In addition, *Entamoeba histolytica* (14.0%), *Entamoeba coli* (5.5%), *Hymenolepis nana* (6.7%), *Enterobius vermicularis* (9.0%), *Ascaris lumbricoides* (4.5%) and *Trichomonas hominis* (10.8%) were also present in the stool samples. Many researchers completed their investigation of the incidence of infection in Al-Diwaniyah by examining the Al-Diwaniyah Teaching Hospital, where the incidence of infection was significantly higher than in prior years (75.0%). The youngest affected group was almost exclusively boys; age ranges were 1 to 10 years; among these children, the seven different types of parasites were distributed as intestinal Amoeba (19.0%), intestinal Helminths (76.0%), and intestinal Flagellates (5.0%). Studies done throughout Iraq and globally have shown the effect that intestinal parasites can have on components of blood. One study by Le et al<sup>4</sup> looked at the relationship between intestinal parasites and anemia in a group of children living in a poor community in Vietnam. They found that the main parasite studied, *Ascaris lumbricoides*, had a prevalence of 25.0% for anemia among those who were infected, of which 2.0% was from iron-deficiency anemia alone. In addition to this, one of the other effects that intestinal parasite infections have is that they change the biochemical makeup of the individual. While the precise mechanism by which they create these changes is not fully understood, another study by Bansal et al<sup>5</sup> found that parasites create changes in the lipid

profile of their host.

From an epidemiological perspective, *Entamoeba histolytica* is present in areas that have contaminated water supplies and poor sanitation. Most cases of this parasite are symptomless, but millions of people are currently infected with it across the globe according to current estimates. Invasive forms of this parasite can cause many serious health consequences such as weight loss, anemia, and/or blood present in stool, which can cause a considerable amount of suffering to those infected by this parasite, especially children<sup>6</sup>. This research aimed to assess the occurrence of intestinal parasites among children from Al-Diwaniyah city residential districts and to find out the relationship between environmental variables, such as temperature, humidity, sunlight, and rainfall, and the transmission patterns of those parasites.

## Methodology

**Study Design:** This descriptive, diagnostic, and epidemiological study was conducted to investigate the prevalence of intestinal parasitic infections among children in Al-Diwaniyah Province and to evaluate their association with selected environmental factors. The study examined the distribution of infections according to age, gender, season, healthcare facility type, and parasite species. Epidemiological and laboratory data were collected and analyzed in relation to environmental conditions and available healthcare services in the study area. The study was conducted in Al-Diwaniyah Province, Iraq. The study was conducted from August 2025 to February 2026. Data were collected through regular visits to the participating hospitals and healthcare centers throughout the study period.

**Sample Collection Sites:** Data were collected from several hospitals and primary healthcare centers in Al-Diwaniyah Province, including Maternity and Children's Hospital, Al-Diwaniyah General Teaching Hospital and Imam Al-Hussein (PBUH) Children's Hospital, Iraq. Primary Healthcare Centers were Al-Tali'a Primary Healthcare Center, Al-Uruba Primary Healthcare Center and Old Housing (Al-Iskan Al-Qadim) Primary Healthcare Center, Al-Jadida Model Primary Healthcare Center and Al-Hakim Neighborhood Primary Healthcare Center. These healthcare facilities were selected because of their high pediatric patient attendance and the availability of medical records required for epidemiological analysis.

**Sample Size and Sample Collection:** A total of 2,145 pediatric cases were screened during the

study period. Among these, 647 cases were diagnosed with intestinal parasitic infections and were included in the study. The study population consisted of children aged 1–12 years who attended the participating hospitals and healthcare centers and were diagnosed clinically or microscopically with intestinal parasitic infections.

**Selection Criteria:** Children aged 1–12 years and positive diagnosis of intestinal parasitic infection based on clinical or microscopic examination were included in his study. Children older than 12 years and children with negative laboratory findings for intestinal parasitic infections were excluded from this study. Hospital records identified infections caused primarily by *Entamoeba histolytica* and *Giardia lamblia*, whereas primary healthcare centers recorded parasitic infections mainly through clinical diagnosis without species identification.

**Data Collection Method:** Data were obtained through a review of medical records from hospitals and healthcare centers. The following information was collected for each participant such as age and gender, date of examination, place of residence, type of healthcare facility, parasite species when microscopic diagnosis was available or clinical manifestations, including abdominal pain, diarrhea, and anal itching.

**Diagnostic Methods:** Diagnosis was performed through microscopic examination of stool samples whenever laboratory facilities were available. Microscopy was used primarily to detect and identify *Entamoeba histolytica* and *Giardia lamblia*. In healthcare centers lacking advanced laboratory facilities, diagnosis of intestinal helminth infections was based on clinical evaluation and symptoms such as anal itching, abdominal pain, and gastrointestinal disturbances. Species-level identification of helminths was not possible in these facilities.

**Study Variables:** The following variables were evaluated such as age, gender, month of infection, healthcare facility type (hospital or primary healthcare center), clinical signs and symptoms, parasite species where microscopic identification was available.

**Table 2: Diagnosed Intestinal Parasitic Infections**

| Parasite Type       | Number of Cases | Percentage    | X <sup>2</sup> | P-value    |
|---------------------|-----------------|---------------|----------------|------------|
| Parasitic Helminths | 417             | 63.47%        |                |            |
| E. histolytica      | 200             | 30.44%        | 327.11         | P < 0.0001 |
| Giardia lamblia     | 40              | 6.09%         |                |            |
| <b>Total</b>        | <b>657</b>      | <b>100.0%</b> |                |            |

\*Degrees of Freedom (df) = 2

**Statistical Analysis:** Data were entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS), Version 26. Descriptive statistics, including frequencies and percentages, were used to summarize the data. Tables and figures were generated to illustrate temporal and spatial distributions of infections. Associations between categorical variables were assessed using the Chi-square test, while Pearson's correlation coefficient was used to evaluate relationships between selected variables. Statistical significance was considered at  $p < 0.05$ .

## Results

Stool samples from youngsters in the province of Al-Diwaniyah were used in this investigation between August 2025 and January 2026. Using statistical analysis of the data gathered, the goal was to ascertain the prevalence patterns of harmful intestinal helminths and parasites. Over the course of the study, 657 positive instances were reported. The findings show a high infection rate of 30.63%, which is regarded as extremely high. This implies that the examined samples were in a condition of hyperendemicity (highest prevalence). This suggests that almost every person in the research region has been exposed to and infected with an intestinal parasite. Furthermore, with clinical symptoms readily apparent in the samples, the high positive rate indicates a serious decline in environmental and health standards (Table 1).

**Table 1: Children Infected with Intestinal Diseases**

| Category     | Frequency   | Percent     |
|--------------|-------------|-------------|
| Infected     | 657         | 30.6        |
| Non-Infected | 1488        | 69.4        |
| <b>Total</b> | <b>2145</b> | <b>100%</b> |

Statistical analysis was performed using the Chi-Square test ( $X^2=327.11$ ) and found a p-value of 0.0001, indicating significant differences in the distribution of infections from different species of parasites. Table (2) displays the positive cases of parasite infection by the type of parasite. Parasitic

helminths had the highest rate of infection (63.47%, 417 cases), which was more than expected. *Giardia lamblia* had the lowest infection rate (6.09%, 40 cases), followed by *E. histolytica* (30.44%, 200 cases). Intestinal aberrations in this cohort predominantly stem from parasites from the helminth class of parasites (63.47%) that are typically associated with contamination of soil or vegetables. High prevalence of *E. histolytica* indicates that contaminated water or unclean hands may cause transmission. While *Giardia lamblia* was the least prevalent, its presence reinforces the myriads of sources that can cause exposure.

There is a distribution of infection rates among males (52.97% to 348 cases) and females (47.03% to 309 cases). This gives evidence of a modest male predominance, with a close approximation between genders. This approximation demonstrates that the cause of infection between male and females is not due to exclusively male behaviours or exclusively female behaviours, but rather through a generalized and shared exposure such as shared drinking water or food contaminated by an infectious agent (Table 3).

**Table 3: Intestinal parasitic infections among Males and Females**

| Gender       | Frequency  | Percent      | P value |
|--------------|------------|--------------|---------|
| Male         | 348        | 52.97        | 0.3675  |
| Female       | 309        | 47.0         |         |
| <b>Total</b> | <b>657</b> | <b>100.0</b> |         |

The distribution of infections across the three age groups was recorded, and the age groups differed significantly from one another according to the Chi-Square test ( $X^2=181.11$ ,  $P<0.0001$ ). In fact, the youngest age range (1 to 5 years) accounted for more than half of the cases (55.56%), making it the group of preference for infection. The rate of infection continues to decline with the increase in age until it reaches its highest point of 12.78% for the age group of 9 to 12 years of age. Therefore, we can conclude that the primary driver of infection rates is age. A lack of or undeveloped immunity along with habits such as playing in dirt and a high

**Table 4: Percentage of Infections According to Age Groups**

| Age Group     | Frequency  | Percent      | P value |
|---------------|------------|--------------|---------|
| 1 to 5 Years  | 365        | 55.6         | 0.0001  |
| 5 to 9 Years  | 208        | 31.7         |         |
| 9 to 12 Years | 84         | 12.8         |         |
| <b>Total</b>  | <b>657</b> | <b>100.0</b> |         |

frequency of creating an "oral-to-hand" pathway, are attributed to this concentration during the early years of life. However, an increase in the number of children with fully developed immunity, improved personal hygiene, and a greater awareness of good health are likely reasons contributing to the decline in the number of older children (Table 4).

Significant variance across the study months is revealed by the temporal analysis ( $X^2=32.27$ ,  $P<0.001$ ). Seasonal and climatic conditions have an impact on infections; they do not happen at random. October had the greatest infection rate (21.93%), which was the peak, followed by September (19.79%). December had the lowest rate (11.72%), which may have been caused by a decrease in the activity of infectious stages in the soil during cold weather or a decrease in children's direct exposure to the outdoors. Rainfall pollution or floods, which may mix sewage with drinking water and reactivate the spread of protozoa like *Amoeba* and *Giardia*, may be the reason for the slight increase in January (15.98%) (Table 5).

**Table 5: Intestinal Infections by Study Month**

| Month        | Frequency  | Percent      | P value |
|--------------|------------|--------------|---------|
| August       | 119        | 18.1         | 0.001   |
| September    | 130        | 19.8         |         |
| October      | 144        | 21.9         |         |
| November     | 82         | 12.5         |         |
| December     | 77         | 11.7         |         |
| January      | 105        | 15.9         |         |
| <b>Total</b> | <b>657</b> | <b>100.0</b> |         |

## Discussion

The data indicate a wide range of parasitic disease representations across major epidemiological indicators. This provides evidence supporting an essential relationship between the environment and human health. The life cycles of these parasites are largely dependent on soil, which is why helminthic disease occurs with such high frequency, being the type with the highest attack rate. Because soil serves as a reservoir for both eggs/larvae (the primary infective stages of helminths), regions lacking effective sewage systems or using wastewater for irrigation will have far more helminthic infections than protozoan infections. Moreover, it is clear that the presence of *Giardia lamblia* and *E. histolytica* in drinking water indicates there is contamination (30.44% and 6.09%, respectively). All of these parasites are transmitted via the fecal-oral route. The co-presence of these parasites in the same sample group suggests that there has been contamination of the hands, improper food handling, or that there has

been a malfunction in the water sterilization systems. The situation is further exacerbated by the long survival of helminth eggs in the environment and their resistance to the weather in areas with inadequate infrastructure.

This study's *E. histolytica* prevalence data agrees with Hussein et al. (2022) that amoebic infections have a close association with sources of water and that the prevalence also generally follows helminth infections in terms of frequency<sup>7</sup>. Thus, this supports the claims by the WHO in 2008, who reported that STHs are more prevalent where there are overlaps between sewage and drinking water systems. In contrast, another group showed that in some cases the prevalence of protozoa in these regions is higher than that of helminthes<sup>8,9</sup>. The difference in these prevalence data can be attributed to geography; protozoan prevalence will increase in urban areas as a consequence of the consumption of contaminated food and water, while helminths will thrive in rural and agricultural areas that involve a high level of soil contact. There is additional demographic information. The similarities in male and female infection rates (52.97% for males, and 47.03% for females) suggest that the source of infections was likely the same, such as contaminated local produce and/or drinking water, as opposed to the activities of the male and female sexes. The high incidence of infected females was likely due to indoor exposure to contaminated food or contaminated water, while the high incidence of infected males has generally been linked to outdoor exposures. Thus, the environment is so full of infectious agents that there is no way for behavioural or biological differences to provide any protection from those infections as shown in tables 4 and 5. Al-Habib et al. As indicated by reports from the Middle East's WHO (2025)<sup>10</sup> it regions show either no gender-related health differences among people and virtually no major differences between who gets sick in that region and how sick they get. However, there were quite a few women in the rural area of Africa studied by Salem et al. (2026) who were more likely to contract diseases as a result of the fact that they are generally exposed to contaminated water than other members of their communities<sup>11</sup>. In a similar study by Osman (2025), boys in India who played outside and consumed food from street vendors exhibited much higher levels of sickness due to their lack of immunity and exposure to potentially unclean living conditions<sup>12</sup>. Young children between the ages of one and five, with immature immune systems, lack of understanding of appropriate sanitation (hand-to-mouth actions), and lack of supervision while in preschool, are more likely to get infected.

This supports the findings of WHO<sup>13</sup> and Jones et al<sup>14</sup>, who found that rates of infection among children enrolled in preschools were similar. Smith and Ward<sup>7</sup> as well as Hussein<sup>15</sup> reported rising frequencies of school-associated infectious diseases amongst the 6 to 12- and 7 to 11-year-old children.

Seasonally, environmental changes and behaviors are factors associated with the much higher rates from August up to September (59.84% combined), then the highest in October (21.93%) corresponding with the beginning of the school year, which enables the transmission to occur due to use of shared facilities and due to the acceleration of food deterioration and activity of house flies, caused by hot summer weather. Similarly, Miller and Post<sup>8</sup> and Al-Saadi<sup>16</sup> have pointed out that the distribution of infections in water coincide with the dry/hot seasons<sup>18,19</sup>. Al-Jadua<sup>17</sup> examined 268 stool samples collected from elementary students and found that *G. lamblia* was the most prevalent parasite, with a prevalence of 23.8%.<sup>17</sup>

Several limitations were encountered during the study such as differences in diagnostic approaches between hospitals and primary healthcare centers, reliance on clinical diagnosis in some healthcare centers due to limited laboratory facilities, lack of detailed parasite species identification in healthcare centers, hospital-based records were mainly limited to *Entamoeba histolytica* and *Giardia lamblia* infections, inability to utilize advanced molecular diagnostic techniques such as PCR and lack of facilities for long-term sample preservation and freezing.

## Conclusion

In this study area, the primary instigators of parasitic disease are related to the environment. Inadequate sewage systems and contaminated soil/water lead to these parasitic infections. Although many parasitic infections are dependent on individual behavioral habits, the similar rates of infection between males and females suggest that both sexes generally share the same environment (i.e., they are exposed to the same environmental threats) rather than solely having to do with their individual choices. Seasonally, the decrease in the oldest of the school-aged children may suggest an improvement in either individual hygiene habits or the safety of schools, while the increase in infections in the second oldest school aged (1 to 5 years) may suggest an inadequately monitored younger child by their parent/carers and unsanitary play settings at home. The seasonal infections are transmitted in two separate yet similar ways: A peak in the fall coincides with the maturation of helminth eggs and soil contamination; a peak in

January is linked to contaminated water and protozoan infections.

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#### Conflict of interest:

The authors declare that there is no conflict of interest regarding the publication of this study.

#### Financial Disclosure

None.

#### Authors' contributions

Abees AK, Al-Abodi HR conceived and designed the study, performed data collection and laboratory work, analyzed the data, interpreted the findings, and drafted the manuscript.

#### Data Availability

Any questions regarding the availability of the study's supporting data should be addressed to the corresponding author, who can provide it upon justifiable request.

#### Ethics Approval and Consent to Participate

Ethical approval was granted by the Research Ethics Committee. The study was conducted in accordance with the Declaration of Helsinki, and written informed consent was obtained from all participants.

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