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Exploring Intestinal Protozoa as a Causative of Diarrhea in Children of Thi- Qar Province

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Annotation: Background: This study is cross-sectional. Common causes of diarrhea in children are intestinal parasites, which have notable worldwide prevalence especially in underdeveloped countries. Common infectious diseases caused by intestinal parasites cause many health problems and compromise growth and physical development. In children, severe infectious diarrhea mostly results from poor environmental sanitation and hygiene, lack of water, and poverty.

Objectives: The purpose of this study was to Investigate the intestinal protozoa causes diarrhea that infects children and know the factors that affect intestinal parasite (protozoa) infection.

Methodology: Fifty fecal samples were collected from pediatric patients experiencing diarrhea. All samples included both genders (25 males and 25 females) and age groups from 1 day to 5 years, collected at Bint Al-Huda Teaching Hospital, Al-Haboubi Teaching Hospital, and Mohammed Al-Moussawi Children's Hospital from various locations in Thi-Qar province between October 1, 2024, and January 10, 2025.

Results: The investigation of intestinal protozoa was conducted through stool examination utilizing both unstained and stained preparations of stool smears. Two species of intestinal parasites were identified. Entamoeba histolytica (69.44%) and Giardia lamblia (30.56%) are among them. Among 50 youngsters, 36 (72%) were identified as infected with intestinal protozoan parasites, with a greater incidence in males at 19 (52.78%) compared to females at 17 (47.22%). A statistically significant difference in the prevalence of intestinal parasites was observed based on sex ($P < 0.05$). Distribution of infection with intestinal parasites was greater in the age range (1-5) year (44.44 %) and lowest (13.89%) in the children less than 1month of age. The change was statistically significant ($P < 0.05$). The prevalence of intestinal parasite infections was highest in the months of October to November (63.89%) and lowest in December to January (36.11%). A statistically significant difference in infection rates was observed between these months ($P < 0.05$).

Conclusions: Entamoeba histolytica exhibits greater prevalence in Thi-Qar province. Age, gender, and month of infection are factors that affect intestinal parasitic infection.

Keywords: Intestinal parasites; Diarrhea; Entamoeba histolytica; Giardia lamblia; Protozoa.

1. Introduction

Intestinal parasites represent a considerable health concern in impoverished countries, especially in tropical and subtropical regions [1]. An estimated 3.5 billion individuals worldwide are anticipated to be impacted, with 450 million thought to be afflicted by these diseases, primarily

children [2].

The prevalence of intestinal parasites differs by location and is influenced by geographical variables, climate, poverty, malnutrition, high population density, personal and community cleanliness, as well as the favorable conditions for the proliferation and dissemination of intestinal parasites [3]. Intestinal parasite infections constitute a significant health issue for children in underdeveloped nations [4]. These infections result in malabsorption, malnutrition, and hinder the growth and development of children [5].

Symptoms of parasite infection encompass anemia, asthma, diarrhea, gastrointestinal disorders, weariness, immunosuppression, anxiety, and dermal rashes". "Infections with intestinal parasites are associated with morbidity, mortality, stunting, physical debilitation, reduced educational attainment, poor reproductive health, and constrained economic development [6].

Diarrhea is the principal factor leading to malnutrition, especially in rural areas, where insufficient sanitation, inadequate hygiene, restricted access to safe drinking water, and low maternal educational attainment intensify its occurrence [7,8]. Approximately 70% of diarrhea occurrences in impoverished nations are attributed to food contamination by intestinal parasites, stemming from insufficient health knowledge and poor hygiene practices [9].

Diarrhea can lead to dehydration, resulting from substantial water loss, and electrolyte imbalance, marked by the deficiency of sodium, potassium, and magnesium, all essential for critical bodily functioning [10].

Diarrhea can lead to serious health consequences, such as environmental intestinal dysfunction, stunted growth, impaired cognitive development, and weakened immunological response [11]. Intestinal parasite infections (IPI) continue to be a significant health concern for children, especially in underdeveloped countries [12].

This study was conducted to emphasize the prevalence of intestinal parasites in Nasiriyah, given the inadequate research on infectious and parasitic disorders among children specifically, and the overall lack of knowledge regarding this issue in Iraq.

Study Objectives:

1. Examine the intestinal protozoa responsible for diarrhea in infants.

2. To identify the factors influencing intestinal parasite (protozoan) infections.

2. Materials and Methods

2.1 Research Methodology

This research is a cross-sectional study conducted from October 1, 2024, to March 1, 2025.

2.2 Patient Study population

This cohort included 50 infants with diarrhea. The participants' ages varied from 1 day to 5 years, comprising 25 males and 25 females, who were treated at Bint Al-Huda Teaching Hospital, Al-Haboubi Teaching Hospital, and Mohammed Al-Moussawi Children's Hospital from various regions in Thi-Qar province. The primary data gathered from patients in this study included: age, sex, residence address, and signs and symptoms.

2.3 Collection of Stool Samples

Fifty stool samples were obtained from patients at various locations in ThiQar Province, including the Bint Al-Huda Teaching Hospital, Al-Haboubi Teaching Hospital, and Mohammed Al-Moussawi Children's Hospital, between October 1, 2024, and January 10, 2025.

2.4 Isolation and Identification of Parasitic Species

2.4.1 Macroscopic Examination

The feces samples were visually inspected prior to microscopic analysis for odor, color, consistency, pus, blood, and mucus [13].

2.4.2 Microscopic Analysis

The initial phase of the current investigation involves identifying positive samples from the total samples taken from probable diarrhea patients, which were inspected microscopically to ascertain the presence of parasites. Samples underwent microscopic analysis within the initial thirty minutes of collection. A light microscope was employed to identify the trophozoite and cyst stages of intestinal protozoa, as well as the eggs and larvae of intestinal helminths.

2.4.2.1 Unstained Stool Smear Preparation

On a glass slide, a tiny stick captured a minute quantity of stool which was emulsified with normal saline (0.5), created by dissolving 8.5 grams of pure sodium chloride (NaCl) in one liter of distilled water. The item was next examined microscopically under a cover slip [14]. Excess fluid was absorbed using filter paper [15], while a cover slip was carefully placed over it to evenly disperse the emulsion into a thin, somewhat homogeneous, and clear layer. “The slide was secured in the microscope and analyzed under the low power 10X objective. Observation initiated from one end of the slide to the other. Upon examining the parasites, cysts, and trophozoites, the specimens were centered and focused under high power for thorough identification.

2.4.2.2 Stained Preparation of Stool Smear

Using an iodine-stained solution diluted in a ratio of 1:5 with distilled water, the nuclear membrane was identified and examined using the stained preparation [15]”. “The approach was utilized to observe the eggs, cysts, and larvae of parasites.

2.5 Statistical Analysis

The impact of age, gender, and month of infection on parasite species (intestinal protozoa) was analyzed utilizing SPSS software (IBM SPSS Statistics for Windows, Version 25, IBM Corp, Armonk, NY, USA). One test employed (Chi-square). The statistical analysis results indicated a significance level of $P \leq 0.05$ for all factors.

3. Results

3.1 Total Intestinal Protozoan Infection Prevalence Depending on the Number and Proportion of Positive and Negative Samples

This study analyzed 50 stool samples from children to detect positive cases among samples acquired from probable diarrhea patients, evaluated microscopically to assess intestinal conditions. The results indicated that the quantity of positive samples exceeded that of negative samples. Table 3.1 shows a statistically significant difference ($P = 0.002$) between the positive and negative samples of the patient groups ($P < 0.05$).

Table 3.1: The count and proportion of positive and negative samples among children suffering with diarrhea

Positive Samples	Negative Samples	Total	P-value	OR
No. Of Sample (%)	No. Of Sample (%)			
36 (72%)	14 (28%)	50	0.002 **S**	0.91

P-value ≤ 0.05 ; S= significant

3.2 Prevalence of intestinal protozoan species in pediatric diarrhea cases

Among 50 stool samples analyzed, two intestinal parasites were identified: Entamoeba histolytica

in 25 samples (69.44%) and Giardia lamblia in 11 samples (30.56%), as presented in Table (3.2).

Table 3.2: The number and proportion of positive stool samples for protozoa species among pediatric patients with diarrhea

Stool Samples				
Parasite species		**NO. of positive samples**	**Percentage%**	**Total**
Protozoa	**Entamoeba histolytica**	25	69.44	36
	Giardia lamblia	11	30.56	

3.3 Determinants of Intestinal Protozoan Infections

3.3.1 Distribution of intestinal protozoan infections by gender

Table (3.3) displays the percentage of infections caused by intestinal parasite species. Based on gender, the total number of children infected with intestinal parasites was 36 out of 50. The maximum number of infected patients was 19 (52.78%) among males, while the lowest was 17 (47.22%) among females. Entamoeba histolytica exhibited a higher prevalence in females than in males, with a proportion of 52%. The prevalence of Giardia lamblia was higher in males than in females, at 63.64%. Statistical analyses revealed that gender significantly affected ($P < 0.05$) the prevalence of intestinal parasite infections.

Table (3.3): Distribution of gut protozoan infections by gender

Gender	**Entamoeba histolytica**	**Giardia lamblia**	**Total**	P-value	OR
	NO. Of sample (%)	**NO. Of sample (%)**	**NO. Of sample (%)**		
Male	12 (48%)	7 (63.64%)	19 (52.78%)	0.012	1.46
Female	13 (52%)	4 (36.36%)	17 (47.22%)	0.034	1.32
Total	25 (69.44%)	11 (30.56%)	36 (100%)		

3.3.2 Distribution of intestinal protozoan infections by age group

Table 3.4 The prevalence of intestinal protozoa species among children of both genders is categorized by age groups, revealing the highest incidence in the 1-5 year age group, followed by the 1-11 month age group, with 16 (44.44%) and 15 (41.67%) instances, respectively. The lowest incidence observed in the age group under 1 month was 5 (13.89%). Entamoeba histolytica had the highest prevalence in the age range of 1-5 years, followed by the age group of 1-11 months, with recorded percentages of 52% and 40%, respectively. The age group under 1 month exhibited the lowest percentage at 8%. Giardia lamblia exhibited the highest prevalence in the age range of 1-11 months, at 45.46%, followed by the age groups of less than 1 month and 1-5 years, both at 27.27%. Statistical tests indicated that age significantly influenced ($P < 0.05$) infection with intestinal protozoa.

Table (3.4): Distribution of intestinal protozoan infections by age group

Age group	**Entamoeba histolytica**	**Giardia lamblia**	**Total**	**P-value**	**OR**
	NO. Of sample (%)	**NO. Of sample (%)**	**NO. Of sample (%)**		
Less than 1month	2 (8%)	3 (27.27%)	5 (13.89%)	0.011	1.39
(1-11)	10 (40%)	5 (45.46%)	15 (41.67%)	.0..0	1.22

month					
(1-5) year	13 (52%)	3 (27.27%)	16 (44.44 %)	0.043	1.30
Total	36				

3.3.3 Distribution of intestinal protozoan species in children with diarrhea by month of illness

Present studies showed a notable link between the month of infection and the rates of intestinal protozoa in youngsters with diarrhea. Respectively, the months were October to November and December to January. Statistical testing revealed that age has a major impact ($P < 0.05$) on the intestinal parasite infection. Statistical investigations showed that the month of infection significantly affected ($P < 0.05$) the infection with intestinal parasites, as shown in Table (3.5).

Table (3.5): Distribution of intestinal protozoan infections by month

Month of Infection	Entamoeba histolytica	Giardia lamblia	Total	Chi-square (P- value)
October –November	12 (52.17%)	11 (47.83 %)	23 (63.89 %)	0.002 **S**
December - January	13 (100 %)	0 (0 %)	13 (36.11%)	
Total	25	11	36	

P- value ≤ 0.05 ; S= Significant

4. Discussion

4.1 General Prevalence of Intestinal Protozoan Infections Based on the Quantity and Proportion of Positive and Negative Samples

This research is a cross-sectional study. The present investigation documented 36 instances of intestinal parasites, affecting 72% of children with diarrhea. The quantity of positive samples in pediatric patients with diarrhea exceeded that of negative samples. This study concurred with [16], which indicated that the proportion of positive samples in pediatric patients with diarrhea was 57.9%, surpassing that of negative samples. The disparities can be attributed to the impact of environmental factors, cleanliness, sanitation levels, and variations in human behavior regarding intestinal parasites [17].

4.2 Prevalence of intestinal protozoan species in children with diarrhea

Common worldwide, intestinal parasite infections nevertheless provide a major public health concern in many tropical and subtropical countries. Using macroscopic and microscopic research, this study discovered intestinal parasites. Children were shown to be infected with two kinds of intestinal parasites, the most common being Entamoeba histolytica at 69.44%, followed by Giardia lamblia at 30.56%. This is consistent with [19], which was conducted in Thi-Qar and showed E. histolytica had the highest incidence, followed by Giardia lamblia with prevalence rates of 29.11% and 12.79%, respectively. The results correspond to [20], which stated that E. histolytica had the greatest infection rate at 41% and Giardia at 34%. Certain parasites' predominance is ascribed to their direct transfer to humans through the eating of food and water tainted with infectious stages, as well as the function of flies as vectors for the parasites[21]. Asserted that the unsanitary practices of serving exposed food lead to infections due to contamination from dust and insects. The results of the study by [22], which identified G. intestinalis as the most prevalent parasite at 47.97%, are contested.

4.3 Determinants of Intestinal Protozoan Infections

4.3.1 Influence of gender on infection by intestinal protozoa species.

The results of the current study show that gender affects the frequency of intestinal protozoan parasites; males had an infection rate of 19 (52.78%), which was higher than the rate of 17

(47.22%) in women. This was related to the differing behaviors of males and females regarding frequent outdoor activities and exposure to infection sources [23]. This aligns with [24] in Baghdad, Iraq, which indicated a greater rate of intestinal parasite infection in males (22.37%) compared to females (21.56%). Disagreeing with Hussein (2022), who asserted that females had a larger frequency of intestinal parasite infections (55.39%) compared to males (44.61%). Other studies in Thi-Qar and Erbil Province revealed a notable frequency of intestinal parasites among both men and women [25]. The comparable prevalence of intestinal parasite infections between sexes may stem from the uniformity of habits facilitating transmission, as well as the analogous behaviors exhibited by children of both sexes during play, particularly among siblings and relatives in economically disadvantaged families. This observation has been corroborated in Najaf and Babylon, indicating that both sexes face equivalent risks of intestinal parasite infection [26].

4.3.2 Impact of Age Demographics on Infection by Intestinal Protozoa Species

Age influences susceptibility to intestinal parasitic infections (protozoa). Results showed that children between the ages of 1 and 5 had the highest infection rate at 44.44%, followed by those under 11 months at 41.67%. As shown in (Table 3.4), the group under 1 month had the lowest infection rate at 13.89%. These findings concur with [27], It found the highest infection prevalence among children aged 1-5 years at 37.75%, followed by those aged 1-11 months at 24.5%. Additionally, results from [19] regarding children under 8 years in Diwaniyah city indicated that the 2-4 year age group exhibited the highest prevalence at 61.7%. This can be attributed to insufficient health awareness, neglect of children's personal hygiene, and variations in children's ages resulting from differing environmental conditions, dietary habits, and living standards.

4.3.3 Impact of the month on infection rates with intestinal protozoa species.

The findings of the present study showed a notable link between the month of infection and the frequency of intestinal parasites in youngsters with diarrhea. The peak incidence was 63.89% from October to November, whilst the lowest was 36.11% in December to January. The period from October to November witnesses a heightened prevalence of infections in warmer climates compared to colder ones, particularly in tropical and subtropical regions. This surge is attributed to increased human activity and exposure to contaminated sources during these months, alongside favorable conditions for the proliferation of parasites and infectious agents, often through the consumption of contaminated juices and food products. These results concur with [28], which showed changes in the frequency of intestinal parasites throughout the study months. The minimum occurrence of 36.36% occurred in January. The rise was notable in infection patterns and months ($P = 0.000$), corroborating the findings of [16], which indicated that the maximum infection rate occurred in October–November at 60.9%, while the lowest incidence was observed in January at 57.5%.

Conclusions

Intestinal parasite infections remain prevalent in Thi-Qar Province, Iraq, posing a significant public health risk to children due to insufficient health awareness and inadequate healthcare services. Giardia lamblia is most frequent in October. This study indicates that gender, age, and month of infection affect intestinal parasite infections.

Recommendations

Individuals should be incentivized to enhance sanitary practices, encompassing personal hygiene and environmental sanitation. A fundamental health education program should be periodically implemented in communities to enhance understanding regarding parasite infections, their prevention, and control measures. The study of the frequency of intestinal parasites in relation to socioeconomic level and prevention should be encouraged.

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