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## Parasitic diarrheal agents among people in Erbil city

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### Abstract

**Background:** The intestinal parasites of *Entamoeba histolytica* and *Giardia lamblia* are among the major causes of diarrhea throughout the world. Despite the remarkable development of diagnostic methods for parasitic diseases and the continuous awareness of their treatment and control, which led to a clear reduction in the spread of these diseases in a number of developed and industrial countries. However, parasitic diseases of all types continue to be a major health problem in many countries.

**Objective:** This study was performed to investigate the prevalence and risk of *E. histolytica* and *G. lamblia* in Erbil City.

**Results:** Out of (12944) samples examined, 1086 (8.39%) were positive by direct microscopic examination, the parasitic species found in the fecal sample were *E. histolytica* (74.40%), *G. lamblia* (25.23%). The prevalence rate of parasitic infection among females (12.87%) was higher than males (7.97%) with a statistically significant difference. According to months the result showed no significant difference, but the highest rate of infection was recorded in May (9.81%) and lowest rate was observed in January (6.62%). Nanakaly Hospital, showed the higher percentage of infection (38.71), while percentage of infection decreased to (8.24%) in Public health laboratory. Double infection with intestinal protozoa were also recorded in (0.37%).

**Conclusion:** According to our study throughout the year, *E. histolytica* has the highest rate followed by *G. lamblia* with female being more commonly infected. Also the single infections were more commonly observed while double infections were rare.

**Keywords:** Diarrhea, Stool examination, *Entamoeba histolytica*, *Giardia lamblia*, Intestinal protozoa

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### Introduction

Outbreaks of acute diarrheal disease have been identified as causes of fatal disease dating back as far as the Sanskrit literature and during Hippocratic times, diarrheal and dysenteric illnesses have played principal roles in the outcomes of military battles throughout history, it was believed that weather and weaning of infants were associated with diarrhea, diarrheal illness was often labelled 'summer diarrhoea' as it was believed to be brought on by summer's heat <sup>[1]</sup>. Diarrhea occurs at some point in the life of nearly every human, when a person has diarrhea the body fluids and salts can be quickly lost from the body, the person becomes dehydrated and this is very dangerous and may kill <sup>[2]</sup>.

Diarrhea is generally defined as the passage of abnormally liquid or unformed stools associated with increased frequency of defecation, Increased frequency is defined by three or more bowel movements a day <sup>[3]</sup>. Globally, an estimated two billion cases of diarrheal disease occur each year. Also, around 1.9 million children under the age of 5 years- mostly in developing countries- die from diarrhea every year, this makes it the second leading cause of death in this age group <sup>[4]</sup>.

The most common, acute diarrhea is defined as the abrupt onset of three or more loose stools per day, it is loose watery diarrhea that lasts one to two days, and it usually goes away after a few days, acute diarrhea can occur in various epidemiological settings including community acquired, hospital acquired, and during travel <sup>[5]</sup>.

Diarrhea that lasts for more than four weeks or comes and goes regularly over a long period of time is called chronic diarrhea, a majority of these patients may have irritable bowel syndrome with co-existing abdominal pain, in developing countries, chronic bacterial, mycobacterial, and parasitic infections are the most common causes of chronic diarrhea [2]. Protozoa are common cause of persistent diarrhea, Giardia is the most often responsible followed by Entamoeba, particularly in immunocompromised patients [6].

Parasitic infections are more common in locations where unsafe drinking water and poor handling of sewage [2] is. Amebiasis or amoebic dysentery is a common parasitic enteric infection, It is caused by any of the amoebas of the Entamoeba group, Amoebiasis may present with no symptoms or mild to severe symptoms, including abdominal pain, diarrhea, or bloody diarrhea, severe complications may include inflammation and perforation, resulting in peritonitis, people affected may develop anemia, if the parasite reaches the bloodstream, it can spread through the body and end up in the liver, causing amoebic liver abscesses [7]. Giardiasis is caused by the protozoa *Giardia lamblia* colonize the upper small intestine by adhering to the apical surface of the epithelium, symptomatic infection with Giardia causes acute or chronic diarrhea, dehydration, abdominal pain and malabsorption leading to malnutrition and weight loss [8].

The prevalence rate of the intestinal parasites is high around the world, especially in developing countries, according to WHO (World Health Organization), three billion people are infected [9]. These infections are often ignored until severing or chronic complications are observed because many of them are usually asymptomatic or manifest only mild symptom. Intestinal parasitic infections (IPs) occur in both rural and urban population, especially in school age children due to their habit of playing or handling infected soils, eating with soiled hands, unhygienic toilet practices and ingestion of contaminated food water or soils, apart from causing morbidity and mortality, these infections can cause iron deficiency, retardation of growth, energy malnutrition and low education performance of school- children [10].

*Giardia lamblia* and *Entamoeba histolytica* germs spread easily from one person to another, just a small amount of these germs can make someone sick, because the germs are in stool, anything that gets contaminated by stool can potentially spread the germs, understanding how to prevent the spread of these germs can help you protect yourself and your loved ones from getting sick [11]. The prevention measure contains, washing hands often with soap and water [12]. Exclude children who are sick with diarrhea from childcare settings until the diarrhea has stopped [13]. At the pool, lake, and other places of swimming do not swallow the water, and do not swim or let kids swim if they are sick with diarrhea [14]. Avoid eating uncooked foods when traveling in countries where the food supply might be unsafe [12]. Our study was done to investigate the prevalence of intestinal protozoa and the risk of the infection among people of Erbil City.

## Materials and methods

### Study population

The study was carried out from January 2021 to December 2021 in Erbil City at Public Health Laboratory Management and Nanakaly Hospital. A total sample were taken from 12944 individuals, (11825) males and (1119) females from different age groups were randomly chosen to be included in

this study.

### Stool sample collection

Stool sample was collected according to the guidelines, a fresh stool sample is collected in a clean sterile screw-top plastic container containing a wooden stick with the sample to be examined directly without wasting time, the specimen container should be clearly labeled with the patient's name, date, and time of passage of the specimen. The patient should be instructed to follow the hygienic rules by washing his hand and submit the stool sample to laboratory not more than ten minutes after collection, and the stool sample should not be contaminated with urine or water [15].

### Examination of samples

#### Macroscopic examination

The test is done by naked eyes and can give a clue about the type of organisms present, the stool samples should be evaluated macroscopically in terms of color (e.g. Brown. Yellow, or other abnormal color), the normal color is tawny due to the presence of bilirubin and bile, in infants the stool may be green, its consistency may be watery or pasty [16]. Consistency (formed, soft, liquid), odor (foul smelling stool may be a sign of infection), the presence of copious mucus or bloody mucus is abnormal, if more than 100 mL blood is lost from the upper gastrointestinal system, black and tarry stool is observed [17].

#### Microscopic examination

Microscopic examination is a diagnostic tool for defining protozoa, helminths, for moving trophozoites, fresh stool can be examined immediately, if it is not possible to examine the stool immediately, it may be kept in 10% formalin for helminths and protozoa, three samples may be needed to be sent on separate days to detect infection because excretion of cysts and trophozoites is variable, the samples are intensified and stained with iodine in order to detect cysts, in invasive intestinal amoebiasis, blood is generally present in stool samples [18]. Microscopic examination is done by using direct smear with either normal saline or iodine wet mount [19].

### Data entering and statistical analysis

The data collected throughout the year has been analyzed using Statistical Package for the Social Sciences (SPSS) version 22. by chi-square test and T-test, P-value  $\leq 0.05$  were considered as statically significant while result  $\geq 0.05$  were considered as statically insignificant.

## Results

### Total number of protozoal infection by direct smear in Erbil City

A total of (12944) samples were examined in current study for protozoal infection using direct smear. The overall percentage of infection was 1086 (8.39%) from 12944 samples investigated as shown in Table (1).

**Table 1:** Total number of protozoal infection by direct smear

Total No. of samples	Positive Samples		Negative Samples	
	No. +ve	(%)	No. -ve	(%)
12944	1086	8.39	11858	91.61

### Prevalence of protozoal infection in relation to gender

The higher percentage of protozoa infection was observed

among females (12.87%) than males (7.79%), and the difference was statistically significant (P-value = 0.039)

using Chi-square as seen in Table (2).

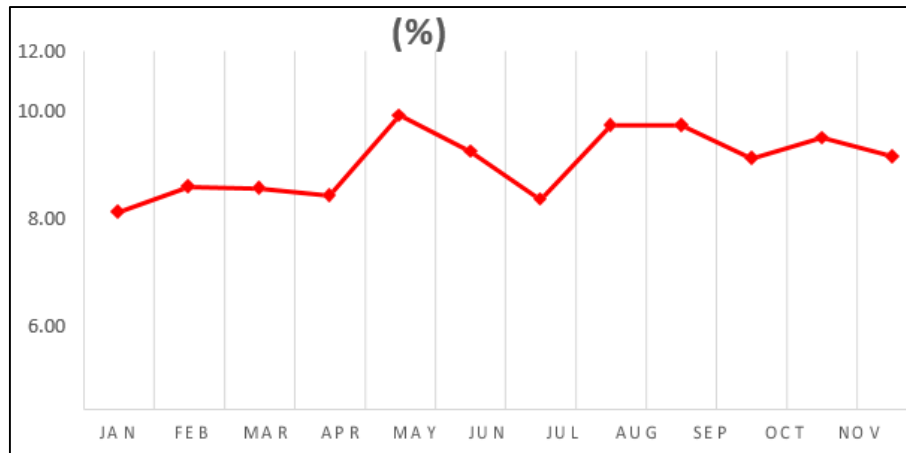
**Table 2:** Prevalence of protozoal infection according to gender among Erbil City

Gender	No. Samples	Positive Samples		Negative Samples		P-value
		No. +ve	(%)	No. -ve	(%)	
Male	11825	942	7.97	10883	92.03	0.039
Female	1119	144	12.87	975	87.13	
Total	12944	1086	8.39	11858	91.61	

**Distribution of protozoal infection according to the months of the study**

As shown in (Figure 1), the highest distribution was observed in May by (9.81%) followed by August (9.49%) and

September (9.48%), while the lowest distribution was observed in January (6.62%), in spite of the differences statistically was non-significant (P-value = 8.921) using T-test.



**Fig 1:** Distribution of protozoal infection according to the months

**Distribution of protozoal infection according to Hospitals or Laboratory**

As shown in (Table 3), the highest positive results were

observed in Nanakaly Hospital (38.71%), while the lowest results were observed in the Public Health Lab (8.24%). The difference was statically significant (P. value= 0.0001).

**Table 3:** Prevalence of protozoal infection in Erbil Hospital and Laboratory

Laboratory	No.Samples	Positive Samples		Negative Samples		P-value*
		No. +ve	(%)	No. -ve	(%)	
Public Health Lab	12882	1062	8.24	11820	91.76	0.0001
Nanakaly Hospital	62	24	38.71	38	61.29	
Total	12944	1086	8.39	11858	91.61	

\* P-value: Significant difference using Chi-square

**Single and double infections caused diarrhea among Erbil City population**

Among our result that have been detected in different Hospitals the highest percentage recorded were (74.40%) for *E. histolytica* and (25.23%) for *G. lamblia* as single infections, while double infection was identified in four individuals (0.37%), which were *E. histolytica* was combined with *G. lamblia* as shown in Table (4).

**Table 4:** Single and double infection among Erbil City population

Parasites	Positive Samples	
	No. Samples	%
<b>Single infections</b>		
<i>Giardia lamblia</i>	274	25.23
<i>Entamoeba histolytica</i>	808	74.40
<b>Double infection</b>		
<i>E. histolytica</i> + <i>G. lamblia</i>	4	0.37
<b>Total</b>	1086	

**Discussion**

Acute diarrhea continues to be a major cause of morbidity and mortality in developing countries [20]. One of the important health problem in human are parasitic infection, the prevalence rates are different according to life level, behavior style and hygienic level [21].

In our study about the diarrheal infection caused by protozoal parasites in Erbil City we collected a total of 12944 samples among Nanakaly Hospital and Public Health Laboratory. Were 11825 males and 1119 females included for prevalence of parasitic infection during 1 year, from January to December 2021, (1086) samples were positive (8.39%) (Table 1). Similar result was observed by previous studies, which were done in Erbil City (11.09%) by [22], and (7.3%) by [23]. Whereas higher result was recorded in both Duhok and Erbil cities (26.1% and 22.8%) by [21] and in Sudan (16.2%) by [24]. While lowest rate was recorded in United Arab Emirates (4.2%) by [25]. The differences in these results may be due to environmental, nutritional, socio-economic,

geographical condition, and health related behavior as well as lack of laboratories technician's education on parasitic infection, or lack of technicians which has efficiency to diagnosis parasites, or that different studies may be using different methods to diagnosis parasites or there are differences of the experience of laboratory experience [26].

According to gender, the percentage of protozoal parasitic infection in females (12.87%) was higher than in males (7.97%) and this difference was statistically significant ( $P$ -value=0.039) (Table 2). Similar result was obtained by other studies carried out in Nigeria by [27] and Saudi Arabia by [28] while another study like that of Baghdad province/Iraq by [29] have shown no significant difference between males and females positive rates of parasitic infection. It is well known that the intestinal parasitic infections are in close relation to the poor sanitary habits and lack access to safe potable water and improper hygiene, the higher infection in females can be justified by considering the females are more exposed to the infective stages of parasitic infection due to the nature of the chores they perform in the house and their life style [30].

According to months our study in comparison to the study of [31], was somehow similar as both are non-significant. While was different from the study in Kuwait by [32]. Although the different months were differ in results, these may be due to people do specific activities in each months, also the pandemic of corona affected greatly on the hospitals as people were less commonly visiting the hospitals making the lowest distribution to occur in January by (6.62%), on the other hand the highest distribution in May (9.81%) and August (9.49%) as shown in (Figure 1) which might be due to the seasonal change as people go outside, do outdoor activities, and meet each other more which affect the rate of transmission.

Our study showed difference in prevalence of protozoal parasitic infection in different places. We observed the higher percentage of infection was (38.71%) in Nanakaly Hospital and decrease to (8.24%) in Public Health Lab. There was a highly statistically significant difference in prevalence of intestinal protozoan infection according to Erbil hospital and laboratory ( $P$ -value= 0.0001) as illustrated in (Table 3). Our result was agreement with [33], and in disagreement with [21]. Nanakaly Hospital is associated with cancer infected, people with cancer infection have weaker immune system that are more susceptible to get infections, especially the infected people are radially to eat or drink contaminated food and close contact with soil, animal and play grounds that might be contaminated with faeces that carry the parasite, and due to low hygiene, but prevalence observed in Public Health Lab is lower because all the cases were healthy and immune competent in which most of the test were done for governmental acquirements.

Most infection in the hospitals are single infections by different protozoa while the double infections are less commonly seen. In our study among the intestinal protozoa *E. histolytica*, exhibited the highest rate of infection (74.40%) followed by *G. lamblia* (25.23%) as observed in (Table 4). These two protozoan remain the most common intestinal parasitic pathogens. Our result was close to finding in Saudia Arabia by [30]. While our result was different from northern Jordan [34]. The presence of *E. histolytica* in the stool suggests the possibility of patients exposure to the environmental conditions that may result in ingestion of contaminated food or water containing pathogenic parasites. Also, it could be attributed to the susceptibility for infection by *Entamoeba*

and/or the availability of the sources of infection by this parasite.

Our study showed four cases of mixed infections with *Giardia* and *Entamoeba* predominantly with (0.37%). The presence of double infection in our study agrees with the study done by [23, 35] which indicated that the main double infections were between *G. lamblia* and *E. histolytic*. This may be related to the unhygienic habits of children and due to the common environmental factors, which may affect their transmission [36].

## Conclusions

According to our study for a period 12 months, we observed low infection by protozoal infection in Erbil City. The females had the highest percentage of protozoan infection than male, and the higher rate of infection was observed in May. It is finalized that *E. histolytica* and *G. lamblia* are present particularly during hot months. Finally, our results show statically significant difference of infection according to location. In addition, we detected double infections by *E. histolytica* and *G. lamblia*.

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