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Article

Electrolyte Disturbance in Diarrheal Children Infected with *Giardia lamblia* in Tikrit City

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Abstract: Background: Giardia intestinalis, or G. lamblia, is a flagellated protozoan parasite that induces diarrhea. Electrolyte imbalances frequently occur in people with diarrhea and can lead to considerable morbidity. Objective: To ascertain the incidence and patterns of electrolyte abnormalities, specifically hyponatremia, hypokalemia, and hypochloremia. Materials and methods: One hundred eighty stool samples were obtained from children of both genders and various age groups, ranging from 2 to 12 years, residing in Tikrit city and adjacent villages, who attended an outpatient clinic between September and December 2025. Result: The samples were examined directly using the Direct Wet Mount technique, and the results showed that 62 samples (34.4%) were positive for Giardia lamblia. The results of infection with the parasite were higher in males than in females, reaching about 45.5%, while it reached 26.2%in females. A significant decrease the mean and SD of sodium, and chloride, diarrheal patient with G. lamblia, that were (135±0.51, 96.2 ±0.78) in compared with control at p-value <0.05. While non -significant differences in potassium level that was (4.71 ±0.06) in G. lamblia as compared with control, at p-value >0.05. Conclusion: This epidemiological study documents the incidence of the intestinal parasite G. lamblia among children in Tikrit, Iraq. The current study concluded an increased prevalence of G. lamblia in children with diarrhea. Furthermore, the prevalence incidence is higher in males than in females. Moreover, the electrolyte imbalance in diarrheal toddlers infected with G. lamblia resulted in decreased salt and chloride levels.

Keywords: Diarrhea, Giardia lamblia, electrolyte

Introduction

Intestinal parasites represent a significant medical issue that severely impacts public health, leading to substantial morbidity and mortality in developing countries like Iraq, where various factors [1]. Giardia intestinalis, or G. lamblia, is a flagellated protozoan parasite that infects the small intestine of both animals and humans. The principal method of transmission is the consumption of contaminated food or beverages. The parasite G. lamblia, responsible for giardiasis, is also the causative agent of another infectious disease with analogous clinical manifestations, such as diarrhea, gastrointestinal discomfort, abdominal distension, and involuntary weight loss [2], [3]

G. lamblia impacts persons globally, including those in affluent countries, however it is more prevalent in areas with inadequate sanitation, resulting in approximately 280 million new human cases annually. In poor countries, the infection rate varies from 10% to 50%, especially among youth in disadvantaged regions [5]. G. lamblia transmits chiefly through contaminated water or food. Additional contributory elements encompass filthy personal practices, contaminated water sources, overcrowded accommodations, inadequate environmental sanitation, unhealthy living arrangements, and diminished economic circumstances [6].

Giardiasis may be contracted by ingesting resilient environmental cysts found in feces, contaminated food, or water. Ingestion of even ten cysts can result in illness in humans. The parasite can readily disseminate among groups, as the mature cysts become infectious upon release following transmission between humans [7].

Electrolyte imbalances are prevalent metabolic disturbances observed in patients arriving at emergency departments (EDs) with acute gastrointestinal manifestations, including vomiting and diarrhea. The abnormalities in sodium, potassium, chloride, and bicarbonate levels are clinically relevant as they may lead to neuromuscular dysfunction, arrhythmia, acute renal injury, and heightened morbidity if undiagnosed [8].

Materials and Methods

A total of one hundred eighty stool samples were collected from children of both sexes and of varying ages, ranging from two to twelve years old, who were residents of Tikrit city and the villages that were adjacent to it and who went to an outpatient clinic between the months of September and December 2025.

We collected approximately 10 grams of fresh stool from each child and placed it in a clean, sterile, disposable plastic stool cup. The cup was clearly labeled with the child's name, gender, age, address, and the date that the stool was collected. By placing a drop of normal saline solution on a glass slide and including a small amount of excrement with a sterile wooden stick, the Direct Wet Mount technique was utilized in order to determine the identity of the parasite.

Blood sample collection

Five milliliters of blood were extracted from 60 patients diagnosed with G. lamblia and 30 healthy individuals in the control group. The serum was isolated from the blood by transferring it to a sterile 10-milliliter gel tube devoid of anticoagulant. The tube was maintained at room temperature for 30 minutes and thereafter centrifuged at 2500 rpm for 10 minutes to extract the serum. The serum was subsequently preserved at -20°C until utilized in the study's experiments.

Assessment of electrolyte

Sodium (Na), Potassium (K), and Chloride (Cl) levels were assessed utilizing various analyses developed by the Japanese business FUJIFILM (FUJI DRI-CHEM SLIDE).

Statistical Analysis:

The data is shown as the Mean ± SEM. The research parameters were compared between the patient and control groups using an unpaired t-test. We used the SAS (2012) software suite to do the statistical analyses [9].

Result and Discussions

Result

The results of the current study showed that 62 samples (34.4%) were positive for *G. lamblia*, while 118 samples (65.6%) were negative result for *G. lamblia*, as shown in Table (1).

Table 1. Infection rates of the *G. lamblia*

Examined samples	Positive result	Negative result
180	62(34.4%)	118(65.6%)

The results demonstrated that males were more likely to have parasitic infections than females, with (45.5% , 26.2%) respectively, as shown in Table (2).

Table 2. Infection rates of the *G. lamblia* according to sex

Sex	*Examined samples*	*Positive result*	*Percentage*
Male	77	**35**	45.5%
Female	103	27	26.2%

Table 3 showed that the levels of Na and Cl were much lower in patients with G. lamblia than in the control group (135±0.51, 96.2±0.78), with a p-value of 0.05. There were no significant changes in K level between groups, with a p-value of more than 0.05.

Table 3. Level of Na, K, and Cl in patients and control

Parameters	Diarrheal patients with *G. lamblia*	Control	P-value
Na mEq/L	135±0.51	140.55 ±0.13	**0.003**
CL mEq/L	96.2 ±0.78	104.98 ±0.06	**0.0065**
K mEq/L	4.71 ±0.06	4.24 ±0.003	**0.08**

Discussion

Giardia lamblia is a major health risk for children because it is a parasite that is more common in some places than others, depending on how clean they are and how rich they are. This statistic corresponds with [10] in Tikrit, which reported a prevalence of 36.2%. Conversely, the results of the current study contradict those reported by [11], which indicated a lower prevalence rate of 14.30%. The prevalence rates of these conditions are significantly different from [12] found a prevalence rate of 15.55.The variation in infection rates observed through microscopic analysis is attributed to multiple interrelated factors, including the volume of samples examined, disparities in environmental characteristics among the studied regions, and behavioral and health determinants such as hygiene practices, population density, and the effectiveness of sewage systems The present study indicated a greater prevalence of G. lamblia in males than in females. This finding supports the research by [13], which indicated that the highest infection rate in males was 63.5%, in contrast to 36.5% in females.

A study by [14] showed the prevalence rate of *G. lamblia* among males was 11 (57.9%) which is higher than female 8 (42.1%). The increased prevalence in males compared to females can be attributed to males' greater mobility and activity levels, which increase their susceptibility to infection due to more frequent interactions in public spaces, exposure to the external environment, and heightened contact with pollutants. Females' movements and activities are more constrained than those of males, and they predominantly remain indoors. Parasitic illnesses are characterized by undernutrition, crucial micronutrient deficiencies, digestive issues, reduced nutritional absorption, and chronic inflammation [16]. Gastrointestinal parasitism can result in electrolyte deficiencies like to those observed in hyperkalemia and hyponatremia [17]. This study concurs with [18] on the reduction in levels of Na and Cl. I disagree with [19], which demonstrated a considerable rise in salt concentration compared to healthy individuals. Soleimani et al. [20] indicated that 67.8% of patients admitted with severe acute diarrhea experienced hyponatremia, implying that this electrolyte imbalance is among the most clinically relevant across many contexts. The current study contradicts [19], which indicated no significant variation in potassium levels. Hypochloremia is caused by the loss of chloride ions from the gastrointestinal system due to diarrhea, vomiting, and nasogastric tube drainage. Intense vomiting can result in a significant loss of chloride relative to sodium, as gastric chloride levels exceed 100 mEq/L while gastric sodium levels are comparatively modest, ranging from 20 to 30 mEq/L. Diarrhea caused by various bacteria might result in markedly varying levels of electrolyte loss in the stool [20].

Conclusion

This epidemiological study documents the incidence of the intestinal parasite G. lamblia among children in Tikrit, Iraq. The current study concluded an increased prevalence of G. lamblia in children with diarrhea. Furthermore, the prevalence incidence is higher in males than in females. Moreover, the electrolyte imbalance in diarrheal toddlers infected with G. lamblia resulted in decreased salt and chloride levels.

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