

Article

The effect of infection of some children with the parasites *Giardia lamblia* and *Entamoeba histolytica* on their Hemoglobin levels

Nawres Alwan Hussain Ali

Department of Biology, Faculty of Science, University of Kufa, Iraq

* Correspondence: nawrasa.ali@uokufa.edu.iq

Citation:

Received: April 11, 2025

Revised: April 29, 2025

Accepted: July 2, 2025

Published: July 11, 2025



Copyright: © 2025 by the authors. Submitted for open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>)

Abstract: The aim of the study was to identify the effect of infection with *Giardia lamblia* and *Entamoeba histolytica* on hemoglobin levels and the relationship between age and infection with these parasites in children. Samples were obtained from Babylon Teaching Hospital for Maternity and Children and the samples were for children aged six years and younger. The total number of infected children was (30) children, including (17) patients infected with *Giardia lamblia*, and (13) patients infected with *Entamoeba histolytica*. Then the parasites were diagnosed microscopically to detect *G. lamblia* and *En. histolytica*, and the hemoglobin levels in the blood were detected by complete blood count (CBC). The ages of the children ranged between (1-72) months. Blood samples were collected from patients between November 2024 and March 2025. The study showed that age was negatively and statistically significantly correlated with hemoglobin levels in patients infected with *G. lamblia*, and similarly, age was negatively and statistically significantly correlated with hemoglobin levels in patients infected with *En. histolytica*. The study indicated that infections with these parasites cause harm to children by reducing their hemoglobin levels, leading to adverse health consequences, particularly for children under the age of six.

Keywords: Kufa, Parasite, *Giardia lamblia*, *Entamoeba histolytica*, Hemoglobin levels

Introduction

Parasites live inside living organisms called hosts and cause a parasitic disease. This disease can be transmitted (Aytac *et al.*, 2025). As the infection progresses, the parasite is stimulated to cause disease in the various organs it invades, causing mechanical or chemical damage or indirect effects such as hyperplasia, organ obstruction, and exposure to other microbes (Celebi Sozener *et al.*, 2022). Infections due to intestinal parasites are a public health concern worldwide, especially in countries with poor sanitation (Debash *et al.*, 2025).

Intestinal parasitic infections (IPIs) remain a serious problem worldwide, with an estimated 3.5 billion people exposed to various types of intestinal parasitic infections, while 450 million people suffer from a wide range of parasitic infections (Bethony *et al.* 2006). Infection with medically important protozoan parasites such as *Giardia* species and *Amoeba histolytica* has been reported to be the most common parasites (Machado *et al.* 2018).

Poor personal hygiene, lack of health education, and malnutrition contribute to the spread of intestinal parasites. The prevalence of parasites is directly related to low socioeconomic factors, harsh climatic conditions, and access to safe drinking water. Sewage disposal and waste management are important factors (Richert, *et al*, 2024) Parasitic infections of the gastrointestinal tract can cause acute blood loss due to bloodsucking, or they may cause mechanical damage to the epithelium. This occurs as a result of disruption of the intestinal epithelial and endothelial barrier at the site of penetration or perforation of the intestine caused by the parasite, leading to poor absorption of nutrients and, consequently, to malnutrition and anemia (Habib *et al*, 2021)

Giardia lamblia is one of the most common protozoan parasites that cause intestinal disease and is a causative agent of persistent diarrhea in humans (Hemphill *et al* ,2019).*Giardia lamblia* is a protozoan parasite that infects the upper small intestine, causing acute watery diarrhea, or giardiasis, in 280 million people annually. Symptomatic infection can also be common, and recent data have suggested that infection may be protective against other diarrheal diseases. Most symptomatic infections resolve spontaneously, but they can lead to chronic disease. *Giardia* infection can also lead to irritable bowel syndrome (IBS) and food allergies after recovery(Einarsson *et al*,2016).

The parasite responsible for amoebiasis is the intestinal protozoan *Entamoeba histolytica*. Amoebiasis is common in developing countries and can affect travelers returning from endemic areas. Approximately 100 million cases of amoebic dysentery and colitis are recorded annually, resulting in 100,000 deaths. According to the World Health Organization, amoebiasis is one of the leading causes of death (Mortimer & Chadee,2010).Infection with intestinal parasites can cause severe anemia in the host due to the continuous blood loss of infected individuals from bleeding ulcers (Obaid, 2014).

Materials and Methods

The subjects

This study included a total of (30) people (children) who were confirmed to be infected with two parasites by diagnosing them with the Microscope for *Giardia lamblia* and *Entameba histolytica* and detecte of HP by CBC analysis by the blood. Their ages of children ranged between (1-72) months. The subjects were examined from blood attending the Babil Teaching Hospital for maternity and children.Samples were collected in the period from November 2024 , Until March 2025.

1-Diagnosis of parasites

Classically, laboratory diagnosis of *G. lamblia* infections by microscopic examination of stool samples.Conventionally, diagnosis is based on the detection of trophozoites or (oo)cysts in stool samples.*En.histolytica* trophozoites was identified by Microscopic examination for the presence of ova and cysts in stool samples,was performed routinely by examination of iodine-stained wet mounts after Formol-ether concentration with a magnification of $\times 400$ (Verweij *et al*,2004).

2- CBC (Complete Blood Count)

The blood sample was collected from a vein using a needle and a dedicated analysis tube according to standard procedures. The sample was stored at room temperature and not exposed to direct heat or light. Samples were collected to determine the hemoglobin level.The sample was entered into the CBC machine.The results are analyzed by the device and then corrected according

to the approved standard normal values. Finally, document the results accurately in the patient's records.

3- Statistical analysis

The statistical analysis was carried out by using the computer software (graph pad prism version 6) and a mean value and standard error (SE) have been obtained for each value. Statistically significant P values less than 0.05 were considered for the statistical analysis Graph pad prism for Windows (5.04, Graph pad software Inc. USA) was used to analyze the data, and the results are reported as the mean, standard error (SE). A student t-test was used to examine the differences between the patient and control groups (Al-Hadraawy *et al.*, 2022).

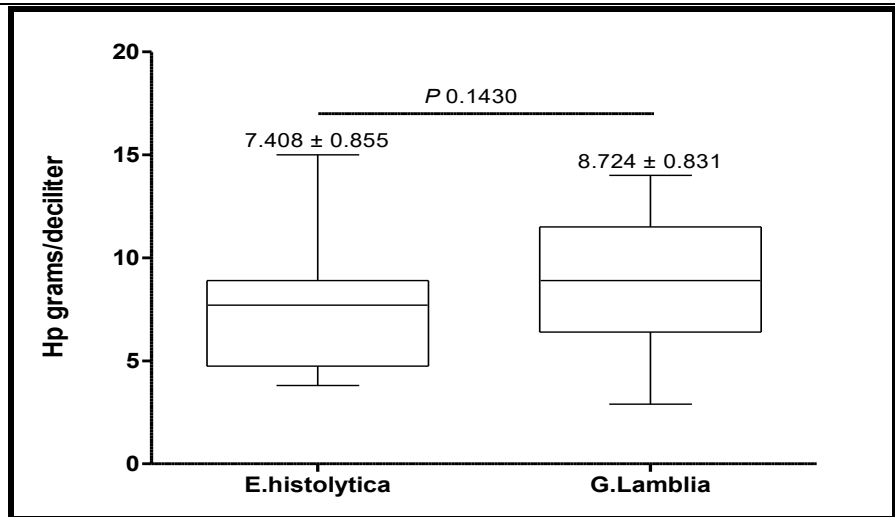
Results and Discussion

Parasite type	Number of infected children	Percentage
Giardia.lambliia	17	56.67%
En.histolytica	13	43,33%
The total	30	100%

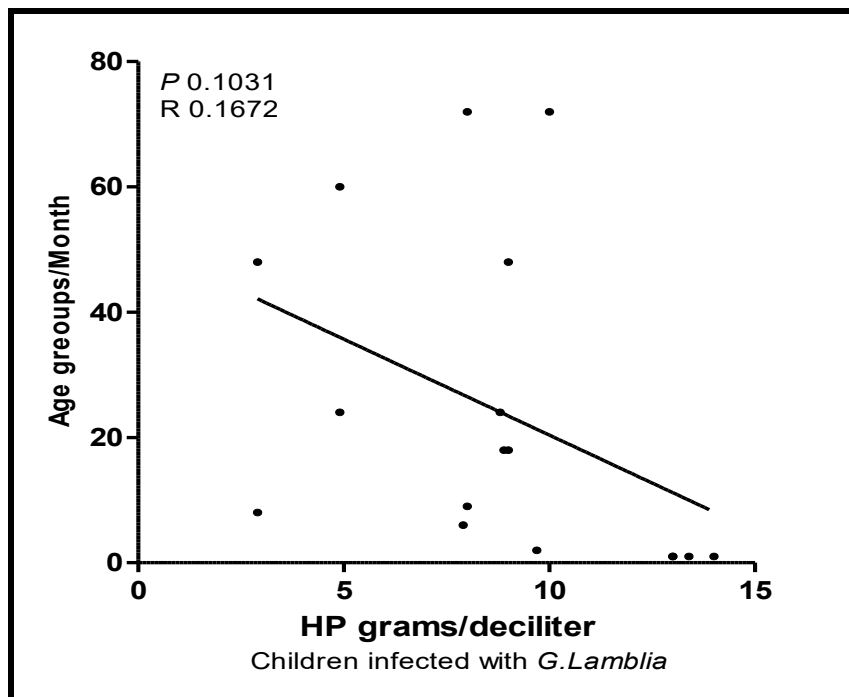
The study showed, according to the table above, that the number of people infected with the *Giardia lamblia* parasite is more than those infected with the *Entamoeba histolytica* parasite among children, and in percentage(56,6%),While the percentage of infection with *Entamoeba histolytica* (43,3%).

G. lamblia infection is a common infection worldwide (Hemphill *et al* ,2019). The reason is a combination of biological, epidemiological, and environmental factors. Among these factors is that *Giardia* contains cysts that are highly resistant to environmental factors. *Giardia* requires only a small number of cysts to be transmitted. It is most prevalent in contaminated water and is transmitted between animals (Adam,2001), While *Entamoeba* is transmitted between humans, its chances of transmission between animals are somewhat limited (Ouattara *et al*,2010)

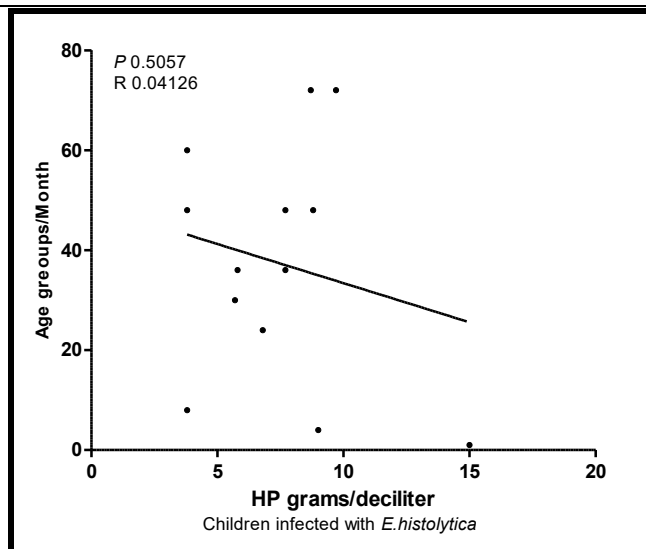
In the statistical analysis of the data in the current study, it was found that: It was found that the range of hemoglobin levels in patients with *Giardia* is between (8.724+_0.831) gm\dec, the range of hemoglobin levels in patients with *Entamoeba* is between (7.408+_0.855) gm\dec. Hemoglobin levels mean was not significant (P>0.05) between *Giardia* and *Entamoeba* patients .



The reason for this is that there are similar mechanisms in affecting the hemoglobin level, as *Giardia* causes malabsorption of nutrients such as iron, and *Entamoeba* causes intestinal bleeding, which affects the hemoglobin level. The infection may not be severe or short-term, so there is no significant difference in the hemoglobin level, or according to the nutritional status of the patient, the duration of infection, and the difference in the individual response to compensate for the hemoglobin deficiency (Safar & Eldash, 2015). The current results revealed that the age correlated negatively and significantly with hemoglobin level in patients infected with *Giardia* ($R^2 = 0.1672$).



The current results revealed that the age correlated negatively and significantly with hemoglobin level in patients infected with *Entamoeba* ($R^2 = 0.04126$).



The negative relationship between age and the risk of *Giardia* and *Entamoeba* infection in children can be explained by the interaction of several factors: immature immune systems, frequent exposure to the parasite, environmental behaviors, socioeconomic conditions, and developing health awareness. As children age, their ability to resist infection improves and their risk of exposure decreases.

Young children, They are often exposed to *Entamoeba* and *Giardia* for the first time and therefore do not have acquired immunity to the parasite. This increases their risk of infection. They often exhibit behaviors that increase their risk of infection, such as putting contaminated hands or objects in their mouths (Ahmed, *et al*, 2016). These behaviors make them more susceptible to contamination with water or food contaminated with this parasite. Young children, They often spend more time in potentially contaminated places, such as nurseries or schools, where the spread of infection is higher. In some resource-limited communities, access to clean water and sanitation may be inadequate, increasing the risk of infection. (Atting *et al*, 2018).

REFERENCES

1. Abd, Z. N., & Al-Hadraawy, S. K. (2023). Study the relationship between hepcidin and IL-6 in patients infected *Entamoeba histolytica*. In AIP Conference Proceedings (Vol. 2414, No. 1). AIP Publishing.
2. Ahmed, T., Khanum, H., Uddin, M. S., Barua, P., Arju, T., Kabir, M., & Haque, R. (2016). *Entamoeba histolytica*, *Giardia lamblia* and *Cryptosporidium* spp. infection in children in an urban slum area of Bangladesh. *Bioresearch Communications-(BRC)*, 2(1), 175-181.
3. Atting, I. A., I batt, O., Akpan, M. I., & Umo, A. N. (2018). *Giardia lamblia* and *Entamoeba histolytica*: Parasitic Causes of Diarrhoea in Children Under-Five Years Old Attending Out-Patient Clinics in South-South, Nigeria. *South Asian Journal of Parasitology*, 1(3), 1-8.
4. Aytac, O., Senol, F. F., Tuncer, I., Dogan, S., & Tuncer, T. (2025). An innovative approach to parasite classification in biomedical imaging using neural networks. *Engineering Applications of Artificial Intelligence*, 143, 110014.
5. Bethony J, Brooker S, Albonico M, Geiger SM, Loukas A, Diemert D, et al. Soil-transmitted helminth infections: ascariasis, trichuriasis, and hookworm. *Lancet*. 2006;367(9521):1521–32
6. Calvao, F., Costa Gileno, D., Malta, J. O., Vientini, V., & Anibal, F. (2011). Anemia in patients with intestinal parasitic infection. *Rev Ibero-Latinoam Parasitol*, 70(2), 206-11.

-
7. Celebi Sozener et al Epithelial barrier hypothesis: effect of the external exposome on the microbiome and epithelial barriers in allergic disease *Allergy*(2022)
 8. Cox, F. E. (2002). History of human parasitology. *Clinical microbiology reviews*, 15(4), 595-612.
 9. Darlan, D. M., Ananda, F. R., Sari, M. I., Arrasyid, N. K., & Sari, D. I. (2018, March). Correlation between iron deficiency anemia and intestinal parasitic infection in school-age children in Medan. In *IOP Conference Series: Earth and Environmental Science* (Vol. 125, No. 1, p. 012059). IOP Publishing.
 10. Debash, M. N., Kumie, G., Sisay, A., Gedfie, S., Abebe, W., Ashagre, A., ... & Reta, M. A. (2025). Burden of intestinal parasites among diabetic patients in Africa: a systematic review and meta-analysis. *BMC Infectious Diseases*, 25(1), 54.
 11. Einarsson, E., Ma'ayeh, S., & Svärd, S. G. (2016). An up-date on *Giardia* and giardiasis. *Current opinion in microbiology*, 34, 47-52.
 12. Gonzalez-Ruiz, A.; Wright, S.G. Disparate amoebae. *Lancet* 1998, 351, 1672–1673
 13. Habib, A.; Andrianonimiadana, L.; Rakotondrainipiana, M.; Andriantsalama, P.; Randriamparany, R.; Randremanana, R.V.; Rakotoarison, R.; Vigan-Womas, I.; Rafalimanantsoa, A.; Vonaesch, P.; et al. High prevalence of intestinal parasite infestations among stunted and control children aged 2 to 5 years old in two neighborhoods of Antananarivo, Madagascar. *PLoS Negl. Trop Dis.* 2021, 15, e0009333
 14. Hemphill, A., Müller, N., & Müller, J. (2019). Comparative pathobiology of the intestinal protozoan parasites *Giardia lamblia*, *Entamoeba histolytica*, and *Cryptosporidium parvum*. *Pathogens*, 8(3), 116.
 15. Kucik, C. J., Martin, G. L., & Sortor, B. V. (2004). Common intestinal parasites. *American family physician*, 69(5), 1161-1169.
 16. Machado ER, Matos NO, Rezende SM, Carlos D, Silva TC, Rodrigues L, et al. Host-parasite interactions in individuals with type 1 and 2 diabetes result in higher frequency of *Ascaris lumbricoides* and *Giardia lamblia* in type 2 Diabetic individuals. *J Diabetes Res.* 2018;2018(1):4238435.
 17. Mortimer, L., & Chadee, K. (2010). The immunopathogenesis of *Entamoeba histolytica*. *Experimental parasitology*, 126(3), 366-380.
 18. Obaid, H. M. (2014). The effect of *Entamoeba histolytica* and *Giardia lamblia* infection on some human hematological parameters. *Journal of Natural sciences research*, 4(12), 44-48.
 19. Ouattara, M., N'guéssan, N. A., Yapi, A., & N'goran, E. K. (2010). Prevalence and spatial distribution of *Entamoeba histolytica/dispar* and *Giardia lamblia* among schoolchildren in Agboville area (Côte d'Ivoire). *PLoS neglected tropical diseases*, 4(1), e574.
 20. Safar, H. H., & Eldash, H. H. (2015). Parasitic infections: is male and female difference for anemia and growth retardation evident?. *Journal of the Egyptian Society of Parasitology*, 45(3), 467-475.
 21. Verweij, J. J., Blangé, R. A., Templeton, K., Schinkel, J., Brienen, E. A., van Rooyen, M. A., ... & Polderman, A. M. (2004). Simultaneous detection of *Entamoeba histolytica*, *Giardia lamblia*, and *Cryptosporidium parvum* in fecal samples by using multiplex real-time PCR. *Journal of clinical microbiology*, 42(3), 1220-1223.