

Effect of Fat-Soluble Vitamins and Lipase on Giardiasis

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Abstract: Background: Giardiasis is a common parasitic disease that infects the small intestine in humans. It is caused by the protozoan parasite *Giardia lamblia*. It is a common disease among humans and animals and is responsible for more than 280 million cases annually worldwide.

Objectives: The current study aims to investigate the effect of fat-soluble vitamins and the enzyme lipase in people with giardiasis and the spread of the parasite in the city of Samarra and Collect blood samples

Methods: This study conducted in Salah Al-Deen hospitals and Samarra hospital in Salah Al-Deen Province, 100 positive cases are obtained by direct smear and collection blood sample to biochemical variables

Results: The results showed a significant decrease in the lipase enzyme, which reached (7.785 ± 4.402) IU/ml compared to the control group (32.765 ± 7.063) IU/ml. As for vitamins, they increased compared to the control group, as vitamin A reached (220.4 ± 71.4) (pg/ml) compared to the control group (212.03 ± 74.5) pg/ml, as well as an increase in vitamin D (14.41 ± 4.04) pg/ml compared to the control group (22.55 ± 5.81) pg/ml, As well as vitamin E (3.582 ± 0.393) pg/ml compared to the control group (3.451 ± 0.437) pg/ml and vitamin K (171.9 ± 26.5) pg/ml compared to the control (192.7 ± 16.2) pg/ml.

Conclusions: Vitamins and enzymes were affected by parasite infection.

Key points: lipase enzyme, giardiasis, vitamin A, k, E, D3, epidemiology, fat-soluble vitamins.

Introduction:

Diarrheal disease is one of the top ten causes of death in all age categories, so it constitutes an important threat to global health, given that it is the second leading cause of death related to infectious diseases, and it is important to control the causes that lead to diarrhea, including giardiasis, to reduce the possibility of an increase in deaths related to diarrhea [1]

Giardiasis is considered a major cause of diarrhea throughout the world, infecting 280 million people annually. The parasite *Giardia lamblia*, also known as (*Giardia intestinalis*, *Giardia duodenalis*), which is the causative agent of this disease, is one of the eukaryote flagellate parasites and causes giardiasis [2]. Therefore, it is considered a common disease between humans and animals. The parasite infects the small intestine (jejunum and ileum) of humans. Infection with the *G. lamblia* parasite occurs after ingestion of the parasite's cysts, and the infection can cause significant damage to the intestinal lining as a result of the parasite's adhesion, with the help of its two-lobed absorbent discs, to the intestinal lining [3]

The people most affected by giardiasis are those who suffer from immune deficiency, in addition to travelers to areas with high rates of infection with this parasite [4]. The infection may occur without symptoms, or clinical symptoms usually appear in the form of foul-smelling diarrhea, abdominal

pain, and bloating. The infection may lead to long-term disorders such as irritable bowel syndrome (IBS) and chronic fatigue [5].

It may cause many complication in those affected, such as malabsorption, weight loss, and delayed growth and development [6], the infection with this parasite cause an imbalance in some chemical and immunological indicators of the body, as the body's immunity markers are affected by the parasitic infection, including the lipase enzyme and the intestinal endocrine glands in the small intestine, it is an indicator of the presence of fat in the intestine and stimulates the secretion of bile to aid in the process of digestion and absorption of fat [7]

Methodology:

Study samples:: The study included the collection of 100 fecal samples from children and adults who suffer from diarrhea and who frequent Samarra General Hospital and those hospitalized there. Their ages range from children 2 months old to adults 60 years old if the patients were given clean sterilize plastic bottles to collect samples and then record information about each patient, including the following information:

(Age, gender, residence, presence of other infections) After confirming infection with the parasite through a direct swab, blood samples of 5 ml were obtained from a vein from each infected person, using a disposable syringe.

Procedure:

Examination of fecal samples: Fecal samples were examined to detect the presence of cysts or vegetative stages of the *Giardia lamblia* parasite to confirm the presence of infection using the Direct Method, according to [8].

Wet swabs were taken from patients' stool and mixed with drops of physiological solution on the glass slide, with a drop of iodine tincture added for parasitic staining. The sample was then covered with the cover of the slide and then examined under an X40 microscope.

Collect blood samples

special laboratory tubes were used for blood samples, (5) ml of blood was placed in in the centrifuge for 15 minutes at a speed of 3000 rpm, and the serum resulting from the separation process was distributed using a micropipette into the following:

- 1- Place 1 ml of the extracted serum in sterile and marked 5 ml plastic tubes, then placed in the freezer at a temperature of -20 C° for preservation in the event of re-examination or the need for more serum.
- 2- Place the remainder of the serum in plain plastic tubes free of any anticoagulant for performing hormonal detection. For accuracy in the results, each form was numbered and the name and date written.
- 3- Lipase enzyme and vitamins were measured according to the manufacturer's instructions using an ELISA device

statistical analysis

The arithmetic means of the coefficients were tested using the Dunkin multiple range test at a significance level (0.05) to determine the significant differences between the groups. As for the percentages, the differences between them were compared with the Chi-square test.

Results:

Examination of stool samples

After examining 100 faecal samples, the current study reached the following results: 8 individuals suffered from infection with the *Giardia parasite*, at a rate of 8%, as in Table (1).

Table (1) percentages of Giardiasis infection

Groups	numbers	%
Negative samples	92	92
Positive samples	8	8
Total	100	100

The current study revealed that there are significant differences between the infection rate between males and females (6.66% and 9.09%, respectively), The current study revealed that patients aged 1-10 years had the highest rate of infection among males and females (4.44% and 3.63%, respectively), and as shown in Table (2),

Table (2) Number and percentage of giardiasis samples according to sex and age groups

Age	Males' samples	infected	%	P value	Females' samples	infected	%	P value
Under-1 year	5	1	1.81	Ab	7	1	2.22	Ab
1-10 year	20	2	3.63	Aa	15	2	4.44	Aa
11-20	1	0	0	Ac	1	0	0	Ac
21-30	6	1	1.81	Aa	12	0	0	Bc
31-40	12	0	0	Ac	2	0	0	Ac
41-50	4	0	0	Ac	2	0	0	Ac
51-60	7	1	1.81	Ab	6	0	0	Bc
Total	55	5	9.09		45	3	6.66	

Similar letters indicate that there are no significant differences ($P \geq 0.05$) between the groups.

Different letters indicate significant differences ($P \geq 0.05$) between the groups.

Capital letters indicate comparison between the totals of one row (horizontal comparison).

Lowercase letters indicate comparison between the totals of one column (vertical comparison).

The study showed that there were significant differences between the parasite and the location of residence. The infection rate reached 5% in city residents and 3% in rural areas. Statistical tests also showed that there was a significant difference at the level of <0.05 . that shown in Table (3)

Table (3) Number and percentage of Giardiasis samples according to geographical location

groups	numbers			%
City center	59	5	%5	A
Rural areas	41	3	%3	B
total	59	5	%5	

Similar letters indicate that there are no significant differences (probability > 0.05) between the groups.

Different letters indicate significant differences (probability ≥ 0.05) between the groups the second aspect, enzymes and vitamins, the results showed a significant decrease in the level of the lipase enzyme compared to the control group, as in Table (4),

Table (4) Lipase enzyme level

Groups	Lipase enzyme (IU/ml)	Value P
	Average \pm standard deviation M \pm S.D	
Infected with parasite	7.785 \pm 4.402	a
Control	32.765 \pm 7.063	b

Similar English letters indicates that no significant differences at $p < 0.05$ level comparison between groups

The results for vitamins showed an increase in the level of vitamin A in people infected with the *Giardia lamblia* parasite (273.5 ± 81.4) dl/mg compared to the control group (9.45 ± 224.04) dl/mg as well as an increase in vitamin D (14.41 ± 4.04) picograms/ml compared to the control group (22.55 ± 5.81) picograms/ml As well as vitamin E (3.582 ± 0.393) pg/ml compared to the control group (3.451 ± 0.437) pg/ml and vitamin K (171.9 ± 26.5) pg/ml compared to the control (192.7 ± 16.2) picogram/ml Table (5)

Table (5) Vitamin A , D , E , k, level in infected

Parameters Groups	Vitamin A (pg/ml)	Vitamin D (pg/ml)	Vitamin E (pg/ml)	Vitamin k (pg/ml)
Infected with giardia	220.4 ± 71.4 a	14.41 ± 4.04 a	3.582 ± 0.393 a	171.9 ± 26.5 a
Control	212.03 ± 74.5 a	22.55 ± 5.81 a	3.451 ± 0.437 a	192.7 ± 16.2 a

Similar English letters indicates that no significant differences at $p < 0.05$ level comparison between groups

Discussion

The results of the current study showed that the total infection rate with giardiasis was 8 % this study confirmed the results of previous studies conducted on the spread of the parasite, and this percentage is close to the study [9] In the city of Baqubah, 8.371%, and [10] in India recorded an infection rate of 7.2%. The infection rate recorded in this study is also close to the infection rate recorded in northern Portugal [11], at 8.4%. Also, the rate recorded in the current study is lower than what was recorded in Nineveh Governorate and in the Amazon, at 20.4% [12], while the infection rate recorded in the current study is higher of the infection rate recorded by [13] in Tehran, which amounted to 2.5%.

The difference in the infection rate may be due to the difference in the number of study samples, the diagnosing procedure, environmental factors, sources of drinking water, the time of study in summer or winter, and the epidemiological nature of the parasite, as it is not constant from year to year and between city and city in the same country. The nutritional status of children and the different ages involved in the study.

Infection rate between males and females (6.66% and 9.09%, respectively), and as shown in Table (2) and this was confirmed by [14,15,16,17]. The infection rate in males is higher than that in females. This may be due to the multiplicity of activities, events, and tasks carried out by males compared to females, and it differs from [9], while a similarity was found in the infection rate between males and females (8.3899%, 8.356%, respectively).

The reason may also be due to the fact that the number of infections in males is higher than in females, in addition to some social customs that pay attention to males more than females. It was concluded [18,19] that the gender factor is linked in its effect on the rate of infection with *Giardia lamblia* with other factors such as the nature of nutrition. And living. اكتب المعادلة هنا.

The highest rate of infection was in the age group (1-10) years, and the results agreed with (20 and 21). The reason for the high rates of infection with this parasite in the age groups may be due to the ignorance of this group and their lack of knowledge of the rules of general hygiene and the fact that children at this age are more mobile and active. In addition to children's habits of playing in contaminated dust in pools or sewers with contaminated stagnant water, as well as eating food and

ice cream from street vendors, or the reason is due to acquired immunodeficiency among these children [22].

As for the place of residence, it has increased more among city residents than in the countryside. The results agreed with [23], who recorded an infection rate of 5.3% in the countryside and a rate of 7.4% in the city. However, the current study does not agree with previous study by [24], who recorded an infection rate of 17.9% in the countryside, which is the infection rate is higher than 14% in the city. The development in the cultural level and the interest in the health aspect by the city's residents through early examination and diagnosis of the disease is an important factor in the lowering infection rate among the city's residents.

The reason for the difference in the infection rate recorded in the current studies compared to the other studies mentioned may be due to the difference in population density and climatic conditions that have a role in the survival and spread of parasites and sanitation services, as well as the difference in the total number of samples examined and diagnostic methods and techniques Used [25].

The second aspect, enzymes and vitamins, the results showed a decrease in the level of the lipase enzyme compared to the control group, this study agree with [26] while disagree with [27]. That difference between the current result and the results of the few previous researches may be activity of parasite itself, strain of parasite, experimental conditions and activity of lipase enzyme, intestinal parasite effect in the level of activity of pancreatic enzymes by reducing the absorption in the intestine [28].

The results for vitamins showed an increase in the level of vitamin (A, E) and low in vitamin (D,k) in people infected with the *Giardia lamblia* parasite compared to the control group.

The results of this study were consistent with the study of researcher [29] if there were no differences in the average daily consumption of vitamin A between the control group and the infected group. The study differs from [30,31], which found significant differences in vitamin A concentration between the group infected with the parasite and the control group.

It also differs from what researchers [32] found in their study they conducted in Tehran, where a significant effect of *Giardia lamblia* on the level of fat-soluble vitamins (A, D, E, K) was observed in infected individuals.

The current results are explained by the lack of significant differences between those infected and those who were not infected. This may be due to the period of infection in people being short and not chronic and not lasting several days, and the body did not lose its stores of fluids and vitamins that it consumed before the infection.

Since the study included a group of children whose ages range from (6 months to 10 years), whose food is healthy and fortified with vitamins and important elements for nutrition, which is due to the health awareness of families in the recent period, which helped maintain the level of vitamins in the blood when infected. Vitamin deficiency is common in children who suffer from malnutrition, as the child is more susceptible to diseases, which may include giardia, and thus giardia impairs the absorption of mineral elements and vitamins and makes them ineffective [33].

Because of the importance of his disease, many studies have attempted to evaluate the association of *Giardia* with poor growth and dwarfism in young children. Old references also indicate that infection with the *Giardia* parasite at an early age was indeed a risk factor for stunting at the age of two years [34].

References

1. Roshidi, N., Mohd Hassan, N. H., Abdul Hadi, A., and Arifin, N. [2021]. Current state of infection and prevalence of giardiasis in Malaysia: a review of 20 years of research. PeerJ, 9, e12483

2. **Kumar, S., and Singh, V. A. [2016].** Prevalence of *Entamoeba histolytica* and *Giardia lamblia* infection in a Rural Area of Haryana, India. *Int. J. Curr. Micro. Appl. Sci*, 5(6), 204-209.
3. **Thompson, R. C., Kutz, S. J., and Smith, A. [2009].** Parasite zoonoses and wildlife: emerging issues. *International journal of environmental research and public health*, 6(2), 678-693
4. **Ahmad, A. A., El-Kady, A. M., and Hassan, T. M. [2020].** Genotyping of *Giardia duodenalis* in children in upper Egypt using assemblage-specific PCR technique. *Plos one*, 15(10), e0240119.
5. **Ferguson, L. C., Smith-Palmer, A., and Alexander, C. L. [2020].** An update on the incidence of human giardiasis in Scotland, 2011-2018. *Parasites and vectors*, 13(1), 291.
6. **JASIM ,M.M., SHAKIR ,O.M., AL-SHAIBANI,K.T.[2020].** The effect of *Giardia lamblia* parasite on some immunoassays and interleukin-10, nitric oxide NO, and sodium ion. *International Journal of Pharmaceutical Research Vol 12 , Issue 2 , 2645 - 2653*
7. **Feingold KR and Grunfeld C. [2022].** The effect of inflammation and infection on lipids and lipoproteins. In: *Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc., 2000-2022 Mar 7.* <https://www.ncbi.nlm.nih.gov/books/NBK326741/>.
8. **Ellam, H. ; Verlander, N. Q. ; Lamden, K. ; Cheesbrough, J .S. ; Durband, C. A. and James, S. [2008].** Surveillance of giardiasis in Northwest England 1996-2006: impact of an enzyme immunoassay test. *Euro Surveill.*, 13(37): 189 pp
9. **Al-Hassani, Intisar Mahdi Hamad. [2012].** Molecular investigation and extent of the spread of the *Giardia lamblia* parasite in the city of Baqubah. Master's thesis, College of Education, Life Sciences Department, Adiyala University.
10. **Wani, S.A.; Ahmad, F.; Zargar, S.A.; Ahmad, Z.; Ahmed, P. and Tak, H. [2007].** Prevalence of intestinal parasites and associated risk factors among school children in Srinagar City, Kashmir, India. *Kor. J. Parasitol.* 993(6):1541-1543.
11. **Amanda. D. Health line. [2018].** Giardiasis. In: 12/4/2022. (<https://www.healthline.com/health/giardiasis>), and *Entamoeba histolytica / dispar* infection with drinking water
12. **Al Kalak, Sondos Nazir and Al Nuaimi, Bushra Hassan Saeed [2007].** An epidemiological study of some parasites causing diarrhea in children in Bartella and Wana districts in Nineveh Governorate, northern Iraq. *Kufa Journal*, 8 (4): 59-69.
13. **Akhlaghi, L. ; Shamseddin, J. ; Meamar, A.R. ; Razmjou, E. and Oormazdi,H.[2009].** Frequency of intestinal parasites in Tehran . *Iranian*.
14. **Ejiofor, O.S.; Onyire, A. and Ofomata, J.A. [2011].**The prevalence of *Giardia lamblia* in children presenting with diarrhoea at secondary health facility in Awka, South-East Nigeria. *Europ. J. Sci . Res.*, 57(4) 529-532 .
15. **Salbi, Ihsan Muhammad Rashid and Ibrahim Fadl [2010].** An epidemiological study of the causes of parasitic diarrhea in humans in the city of Karbala. *Proceedings of the Tenth Scientific Conference of the College of Veterinary Medicine: 256-271*
16. **Ihasan, M.A; Hadith, S.A. and Hussain, S.A [2017].** The prevalence of some gastrointestinal nematodes and cestodes in Iraq. *Asian Biomedicine*10(1):16-66.
17. **Al-Safo, Fatima Hussein Youssef Zamil [2012].** An epidemiological study of the parasites *Entamoeba histolytica*, *Entamoeba dipar*, other parasites and associated microorganisms, and the effect of parasite infection on some laboratory tests in children in the city of Tikrit. Master's thesis, College of Education, Tikrit University.
18. **Al-Mekhlafi, H. M.; Al-Maktari, M. T.; Ahmed, A.; Anuar. T.S.; Moktar, N.; Mahdy, M. A. K., et al. [2013].** Burden of *Giardia lamblia* is infection and its adverse effects on growth of school children in rural Malaysia. *Plos Neglected Tropical Diseases*, 7(10):1-12.

19. **Al-Douri, Nahed Iyad Fares Abdullah .[2017]**. The spread of intestinal parasites among students in some primary and secondary schools in the city of Tikrit and the effect of infection on some immune parameters. Master's thesis, College of Education for Pure Sciences, Tikrit University
20. **Alfonso, J.; Rodrigues-Moralis; Santiago Granados Alvarez; Harold Escudero-Quintero; Felipe Vara-Polania, et al. [2016]**. Estimating and mapping the incidence of giardiasis in Colombia, 2009-2013. *International Journal of Infectious Diseases*. 49:204-209.
21. **Naz, A Nawaz Z Rasool,M H ahoor M. [2018]**. Cross-sectional epidemiological investigations of *Giardia lamblia* in children in Pakistan Sao Paulo Medical Journal, 136(5), 449-153.
22. **Anim_Baidool, Narh C.A.; Oddei, D., et al. [2016]**. *Giardia lamblia* in fections in children in Ghana. *Pan Afr Med J*. 24:217. PMID: 27800072; doi : 10.11604/pamj.2016.24.217.8012.
23. **Júlio, C. ; Vilares, A. ; Oleastro, M. ; Ferreira, I. ; Gomes, S. ; Monteiro, L. ;Nunes, B. ; Tenreiro, R. and Ângelo, H. [2012]**. Prevalence and risk factors for *Giardia duodenalis* infection among children: A case study in Portugal. *Parasit. Vect.*, 5 : 22 – 30
24. **Rayan, P. ;Varghese, S. and McDonnell, P.A.[2010]**. Geographical location and age affects the incidence of parasitic infections in school children. *Indian. J. Pathol. Microbiol.*, 53(3) : 498-502 . (Abstract) .
25. **Zangana, Media Muhammad Bakr. [2018]**. An epidemiological study of the *Giardia lamblia* parasite and the effect of infection on some hematological and biochemical parameters in children in the city of Kirkuk. (Doctoral dissertation), College of Education for Pure Sciences, Tikrit University.
26. **Al-musawy,F.A.B., Hussein,M.F.[2023]** Evaluation of interleukin -1 alpha, lipase and vitamin D3 in patients with giardiasis, *Big Data & Health Care* Volume 2, Issue 1, No. 3.
27. **Abed, N. T., Mohamed, N. S., Abdel-Gawad, E. R., & Ibrahim, S. G. [2014]**. Vitamin D status in children with recurrent acute diarrhea. *Int J Curr Microbiol Appl Sci*, 3(11), , 858-868.
28. **Al-Quraishi, M. A., & Al Hrbey, S. R.[2020]**. Biochemical Study for Patient with Mainprotozoa Diarrheal Agents in Babylon Province, Iraq. *Annals of Tropical Medicine and Public Health*, 23, 231-208. DOI: 10.36295/asro.2020.231208
29. **Quihi-cota I,etal[2008]**.impact of *Giardia intestinalis* on vitamin astatus in school children from northwest mexico.*int.j.vitam.nutr.res.*75(2):51-56
30. **Khalaf, Widyan Mohi Ali. [2022]** The effect of infection with the parasite *Giardia lamblia* on some physiological and biochemical variables in the city of Samarra, Master's thesis, College of Education, University of Samarra.
31. **Khlf ,W.M.,Shakir,O.M.[2022]**. The effect of infection with the parasite *Giardia lamblia* on some physiological, hormonal and biochemical variables *Journal of Pharmaceutical Negative Results* | Volume 13 | Special Issue 6 | 2022
32. **Saki, J., Khademvatan, S., Maraghi, S. & Soltani, S.[2011]**. Serum lipid profiles and eosinophilia among *Giardia* cyst passer. *African J. Microbiol. Res.*, 5(27): 4881–4884.
33. **Bartelt, L.A., Roche, J., Kolling, G., Bolick, D., Noronha, F., Naylor, C., Hoffman, P., Warren, C., Singer, S., Guerrant, R. [2013]**. Persistent *G lamblia* impairs growth in a murine malnutrition model. *J. Clin. Invest.* 123, 2672–2684
34. **Rogawski, E.T., Bartelt, L.A., Platts-Mills, J.A., Seidman, J.C., Samie, A., Havt, A., et al. [2017]**. Determinants and impact of *Giardia* infection in the first 2 years of life in the MAL-ED birth cohort. *J. Pediatric Infect. Dis. Soc.* 6, 153–160.