

# A Study of Some Blood Indicators Associated with Infection with the Intestinal Parasite *Entamoeba Histolytica* in Diabetic Patients

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## Abstract

This study was conducted on people attending hospitals in Babil Governorate and its environs from October 2022 to March 2023 to determine the relationship between the intestinal parasite *Giardia lamblia* and its relationship to diabetic patients by determining some blood indicators (White Blood Cells, Erythrocytes sedimentation rate, packed cell volume, Hemoglobin,) and biochemistry. (Blood.Sugar , Hemoglobin A1c , Blood .urea , serum .creatinin ,uric acid , High Density Lypoprotein -cholesterol , , C- Reactive protein) This study included the collection of (157) samples, including (35) stool samples from people who were confirmed to be infected with the Entamoeba parasite *Histolytica* only to determine some epidemiological indicators of the parasite, including age, sex, and (22) blood samples for people whose infection with *E. histolytica* and diabetes were linked together, and (50) blood samples for people with diabetes only, and comparing them with (50) blood samples from healthy people. The infection rate of those infected with the *E. histolytica* parasite in females was higher than in males, with a significant difference ( $p < 0.05$ ) amounting to (70%) and (30%), respectively. The results also showed that the highest infection rate with *E. histolytica* was in the age group (1-10) years and the lowest infection rate was in the age group  $> 40$  years, with significant differences reaching (48.6%) and (8.6%), respectively. The results showed that the infection rate of females infected with the *E. histolytica* parasite and diabetes was higher than that of males infected with the parasite and diabetes, amounting to (68.2%) (31.8%). The results indicated that for people infected with *E. histolytica* parasite and diabetes mellitus, there was an increase in the level of sedimentation, white blood cell concentration, and the volume of packed cells. And a decrease in hemoglobin amounted to (42mm/hr) 9.03 (cells/mm) (36%) (11.1g/dl) respectively compared to the control group (20mm/hr), 7.5 (cells/mm), (43%, (14.5 g/dl) respectively. As for people with diabetes only, the results showed an increase in the concentration of white blood cells, the velocity of blood sedimentation, and a decrease in the concentration of stacked cell volume and hemoglobin. 4. (9 cells / mm), 42. 5), (28mm/hr %), (13.2 g/dl), respectively. Compared to the control group (7.5 cells/mm), (20 mm/hr), (43.5%), and (14.5 g/dl), respectively. The study showed the results of the biochemical parameters of people infected with the parasite and diabetes, an increase in the concentration of glucose, cumulative sugar, C-reactive protein, high-density lipoproteins of cholesterol, urea, cholesterol, a slight increase in the concentration of uric acid, and a slight decrease in the concentration of creatinine, with no significant difference (254 mg / dl). , 8.7%) (5.9 mg/dl), (0.93 mg/dl), (36.5 mg/dl), (166 mg/dl), (4.7 mg/dl),(0.9mg/dl), respectively, compared to the control group in which (93 mg/dl), (5.5%), (5.5mg/dl), (30mg/dl), (1.2 mg/dl), (160 mg/dl) ), (4.3 mg/dl) (0.95 mg/dl), respectively, and for people with diabetes only, the study found an increase in the level of glucose, cumulative sugar, C-reactive protein, high-density lipoproteins for cholesterol, uric acid, cholesterol, urea, and a slight increase in creatinine concentration. (225.6 mg / dl), (8.6%), 10.7 mg/dl), 1. 1 mg/dl), 5 mg/dl, (179 mg/dl), (33.4 mg/dl), 0.76 mg/dl, respectively.

**Keywords:** diabetic patients; *Entamoeba histolytica*; blood indicators

## 1. Introduction

*Entamoeba histolytica* is a common parasite in Iraq and the world (1986) Al-Abaidy 1998; WHO1997;Wala) causes what is called amoebic dysentery, and the number of infections is estimated at (480) million, causing (40,000 110,000) deaths annually in the world. The disease affects the wall and cavity of the large intestine, especially the cecum and the ends of the small intestine, as it causes perforation of the intestine, bleeding, narrowing of the intestine, granulomata, and may cause appendicitis.

It invades the mucosal and submucosal layer of the intestine, causing inflammation, ulcers, or infiltration of this layer. (1995 Mendis). Amoebas attack the intestinal wall to form ulcers and cause dysentery,

and may travel by blood to sites outside the intestine such as the liver, lung, and brain (Stanley, 2003).Diabetes mellitus (DM) is defined as a group of metabolic disorders that end in hyperglycemia and result either from a defect in the secretion of the hormone insulin or the action of insulin, or both (2010, American Diabetes Association). Diabetes occurs as a result of the deficiency of existing beta B cells. In the pancreas, insulin is not produced in sufficient quantity or stops producing it permanently, and this is known as type 1 diabetes mellitus (T1DM) Insulin-dependent diabetes mellitus, or when the body is unable to use that substance in an adequate manner. Effective and this represents diabetes mellitus - type 2 (Type 2 diabetes mellitus (T2DM) non-insulin-dependent diabetes mellitus (NIDDM)

Insulin hormone is a hormone that regulates the level of sugar in the blood, and diabetes is one of the common diseases that occur due to Lack of control of the level of glucose in the blood, which over time leads to significant damage that affects the structure and functions of body tissues. The main symptoms leading to suspicions of diabetes and high blood glucose Polydipsia is extreme thirst with polyuria and weight loss, and sometimes the patient feels hungry (Gianani, 2005).

The study aims to:

Studying the relationship of infection between intestinal protozoan parasites in patients with diabetes by determining some blood indicators (pcv, wbc, Hb, ESR) and biochemical indicators (B.sug, Hba1c, CRP, Chol, B.urea, S.cr, (HDL-C).

## Materials and methods

### Place of study

The current study was conducted in the hospitals of Babylon and its suburbs, and in some private laboratories.

### Collect blood samples

Blood samples were collected by drawing (5 ml) of venous blood using a wine syringe after sterilizing the area with ethanol at a concentration of 70%. Quietly for 5 minutes (to prevent blood clots) in order to study the blood parameters, which included the percentage of hemoglobin (Hb) and the volume of compressed blood. P. C.V and the differential and total number of leukocytes in the blood. As for the second group, (3 ml) of blood is placed in a test tube and left to clot for half an hour, then the samples are centrifuged using a centrifuge at 3000 revolutions per minute for 10 minutes. Serum is isolated from other blood components using a fine pipette and placed in a 10 ml tube. Then the tubes containing the serum were kept at -20°C until tests were performed on them.

## Experiment design

### 123 samples were collected and divided as follows

1- 50 people who do not have any of the two variables (diabetes or Entamoeba histolytica parasite) and are considered positive controls.

2- 50 people with diabetes only, without a parasite, and it is considered a negative control

3- 35 parasite infected person without diabetes is considered a negative control

4-22 people with parasite and diabetes

Blood tests were performed in the samples of the injured and the control group

Samples examination methods

### 1 - Visual examination

This method included a complete description of the stool in terms of form and consistency as soft, watery, or well-formed, as it gives a description of the type of parasitic organisms present in it. The stool was noted for being greasy or not, as well as the color and smell of the sample, which may be moldy or putrid, such as the smell of arsenic.

## 2- Microscopic examination

### Direct examination method

Faecal samples were examined with the naked eye before the microscopic examination, and the examination included consistency, color, and whether it contained blood or mucus, and whether it contained fatty materials or not (Al-Hadithi and Habash, 2000). The microscopic examination was carried out using the Direct Smear Method, where a drop of normal saline was placed on one side of a clean, dry glass slide and another drop of Lugol's iodine solution on the other side, then a small amount of stool was taken with a stick. A drop of physiological solution and iodine solution were mixed well, then a cover was placed on the slide without causing air bubbles, then the samples were examined by light microscope under two powers (Singh et al., 2009) 40X, 10X).

### Blood tests

Calculating the number of blood cells WBC

The method of blood cell counter and dilution solution (Turke's fluid) was used to calculate the total number of white blood cells (Brown, 1976).

Measurement of the erythrocyte sedimentation rate (ESR).

The Westergreens method was used to calculate the sedimentation rate (Brown, 1976) and Wintrobe's method, and the results were expressed in hour / ml units.

PCV - Compressed cell volume measurement

Capillary tubes, a microcentrifuge, and a hematocrit reader were used to measure and determine the percentage of hematocrit. (1976, Brown).

Hemoglobin Hb level assessment

A hemoglobin meter and Drabkin's solution were used as a dilution solution to estimate the concentration of hemoglobin in a blood sample (Sood, 1992).

Biochemical examinations

Glucose concentration

The concentration of glucose in the blood serum was estimated by using the enzymatic method (Trinder, 1969), which included the use of analysis kits prepared by the Spanish company Bio systems, and the results were expressed in mg/dL units. Another method of measurement is Photometer Boehringer Mannheim 5010 (Summit Book, 2015).

Estimation of cumulative sugar

The cumulative concentration was estimated by the Cobas integra plus 400 device, which works according to the principle of (Absorbance photometry).

C-reactive protein test

This test depends on the immunological interaction that occurs between the human C-reactive protein and the antibodies corresponding to the human CRP antigen attached to the latex particles, as the negative reaction indicates that there is no aggregation, but the positive reaction indicates the occurrence of visible and clear aggregation of the

latex particles on the slide (Ridker et al. , 2005) and there are two ways to conduct the test (The Summit Book, 2015):

- 1 . Qualitative Assay.
- 2 . Semi-quantitative test.

Estimation of high-density lipoprotein cholesterol concentration in blood serum

Serum high-density lipoprotein-cholesterol concentration was estimated using the Photometer Boehringer Mannheim 5010 method (Summit Book, 2015).

Estimation of uric acid in blood serum

Serum boric acid concentration was estimated using Photometer Boehringer Mannheim 5010 (Summit Book, 2015).

- Estimation of creatinine concentration in blood serum  
There are two methods for calculating creatinine clearance (Al-Qimma Book, 2015), namely:

- 1 . Cockcroft-Gault method.
- 2 . Arithmetic method.

- Estimation of cholesterol concentration in the blood serum

Cholesterol concentration was estimated using Photometer Boehringer Mannheim 5010 (Summit Book, 2015).

- Estimation of urea concentration in blood serum

The urea concentration was estimated using the Photometer Boehringer Mannheim 5010 method (Summit Book, 2015).

## 2. Results

Percentage of infection with Entamoeba Histolytica by sex

The results of the current study showed a discrepancy in the rates of parasite infection between males and females, as there were significant differences at the probability level ( $P < 0.05$ ) in the percentage of infection between the sexes, where the percentage was in females (71.4%) and it was in males (28.6%) As in Table No. (1.)

Control		Patients		Gender
Percentage %	The number	percentage %	number	
30	15	25	10	Males
70	35	75*	30	Females
100	50	100	40	Total
		4.5		T arithmetic
		1.96		T tabular p <0.05

1- Infection with the parasite Entamoeba Histolytica by sex

The current results showed a variation in the incidence rates between males and females compared to the control group, as a significant difference was observed at the probability level ( $p < 0.05$ ) ) If females had the highest rate of infection, while the lowest rate of infection was recorded in males. The percentages were 75% and 25% respectively. As in Table (1)

Age Categories	Patients	Percentage %
1 - 10	13	32.5**
11 - 20	7	17.5
21 - 30	5	12.5
31 - 40	5	12.5
> 40	10	25*
Total	40	100
		11.8
		9.49

### 2 - Infection with the parasite Entamoeba Histolytica by age groups

The results of the current study indicated a variation in the rates of infection with the parasite according to different age groups, the results of the statistical analysis showed that there are high significant differences at the level of probability ( $p < 0.05$ ) ) as the highest percentage of infection was in the age group (10-1) years and in the age group >40 and the lowest percentage of infection in the age group (40-21) years and the values were (32.5%), (25%), (12.5%) respectively. As in Table (2)

Control		Patients		Gender
Percentage%	number	Percentage %	number	
32	8	29.4	5	Males
68	17	60.6*	12	Females
100	25	100	17	Total
		4.2		T arithmetic
		1.96		T tabular p <0.05

### 3- Incidence of Entamoeba Histolytica parasite by sex in people with diabetes

The results of the current study showed that there is a variation in the incidence of parasite and diabetes between males and females compared to the control group. If the highest rate of infection in females. The lowest incidence was in males (60.6%) (29.4%) respectively. As in Table (3)

LSD P < 0.05	Control M ± SD	diabetic patients M ± SD	Diabetes and G. lamblia infection together M ± SD	blood parameters
1.1	7.5±1.3	8.4±2.2	*9.7±2.1	WBC
1.3	43±2.1	*40.5±3.6	42.7±4	PCV
1.6	14.5±1.5	*12.4±1.4	13.3±1.8	Hb
5.5	20±5.3	19.4±12.1	*30±10.7	ESR

#### 4- The effect of diabetes, Entamoeba histolytica parasite and diabetes only on the criteria

The results of the current study showed . Table (4) to increase the total number of white blood cells and the sedimentation rate of red blood cells with significant differences ( $p < 0.05$ ) The values were (9.7 cells / mm) and (30 mm/hr) respectively compared to the control group (7.5 cells / mm) and (20 mm/hr) respectively

The results also indicated a decrease in the concentration of compressed blood cells and hemoglobin with no significant difference and the

values of the infected were (42.7%), (13.3 g/dl) respectively compared to the control group (43%), (14.5 g / dl).

The results of the current study for people with diabetes only indicated an increase in the concentration of white blood cells and reached in those affected by 8.4 (cell / mm) compared to the control group (7.5 cells / mm) and the results showed a decrease in the concentration of compressed blood cells and hemoglobin and the rate of sedimentation of red blood cells and the values in the affected (40.5%), (12.4 g / dl), (19.4 mm / hr) compared to the control group (43%), (14.5 g/dl) , (20 mm/hr)

**Table (5) Comparison between people with diabetes, Entamoeba Histolytica parasite and people with diabetes only with control based on biochemical parameters**

LSD P < 0.05	Control M ± SD	diabetic patients M ± SD	Diabetes and G. lamblia infection together M ± SD	Parameters biochemical
10.6	93±21.5	213.4±100.8	*216±10.3	Bl . Sugar
2.6	5.5±1.5	*8.3±3.6	7.9±0.7	Hbalc
4.9	5.5±3.1	6.6±1.4	*13.1±6.3	C.R. protein
5.6	57.3±6.9	64.4±8.7	*38 ±6.2	HDL - C
1.3	4.3±1.1	6.6±1.6	*3.4±1.6	Uric acid
	0.95±0.2	0.9±0.4	1.13±0.2	S.Creatinine
12.4	160±15.4	171.6±26.8	*130±22.1	Cholesterol
4.2	30±6.1	34.2±15	*40 ±7.2	B. urea
	1±0.02	1±0.23	1.05±0.01	T.S.B

#### 5- Study the effect of diabetes, Entamoeba histolytica parasite and diabetes only on biochemical parameters

The results of the current study indicated that the concentration of (glucose - cumulative sugar - C-reactive protein - creatinine - urea - bilirubin) in patients infected with histolytic amoeba parasite and diabetes led to a significant increase in normal values and the values were shown in Table (4-13) It was (216 mg/dl), (7.9%), (13.1 mg/dl), (1.13 mg/dl), (40 mg/dl), (1.05 mg/dl) respectively compared to the control group (93 mg/dl),( 5.5% ),(5.5 mg/dl),(0.95 mg /dl), (30 mg/dl), (1 mg/dl)

The current results also showed a decrease in the concentration of (high-density lipoproteins - uric acid - cholesterol) and the values were (38 mg / dl), (3.4 mg / dl), (130 mg / dl) compared to the control group

(57.3 mg / dl), (4.3 mg / dl), (160 mg / dl)

The results of the current study also showed that the total concentration of (diabetes - cumulative sugar - C-reactive protein - high-density lipoproteins - uric acid - cholesterol - urea) in patients with diabetes

It only led to an increase in normal values and the values were (213.4 mg /dl), (8.3%), (6.6 mg /dl), (64 .4 mg /dl), (6.6 mg /dl), (171 mg /dl), (34 .2 mg /dl) compared to the control group (93 mg dl), (5.5 mg/dl), (57.3 mg /dl), (4.3 mg /dl), (160 mg /dl), (30 mg / dl) respectively

The results also showed a slight increase in the concentration of creatinine and its value was in patients (0.9 mg / dl) compared to those who were not infected (0.95 mg / dl). The estimation of bilirubin concentration showed that the concentration within normal limits was reached in patients (1mg/dl) and in the control group (1mg/dl). Table (5)

**Table (6) Comparison between people with diabetes carrying the parasite Entamoeba Histolytica and those with diabetes only with control based on immune elements**

LSD P < 0.05	Control M ± SD	diabetic patients M ± SD	Diabetes and G. lamblia infection together M ± SD	Immunoglobulins
20.7	235±10.25	221±92.3	*120±22.3	IgA
66.3	1150±19.3	1206±590	*1020±7.5	IgG
10.3	135±12.2	92±20.7	*141±5.3	IgM

#### 6- Measuring the concentration of immunoglobulins

The current study showed an increase in the rate of concentration of immunoglobulin IgM in infected people, as it reached (141 mg/dl) compared to the control group, which reached 135 mg/dl, while the results showed a decrease in the rate of

concentration of immunoglobulin IgG and IgA with significant differences, and the values were 1120 mg / dl), (120 mg / dl) respectively compared to the control group (mg/dl 1150). (235 mg /dl ) respectively

The results of the current study for people with diabetes only indicated a decrease in the level of IgA and Igm and the values were (221 mg/dl, (92mg/dl) respectively compared to the control group (235

mg/dl), (135mg/dl), while the results showed an increase in the level of immunoglobulin IgG and amounted to (1206 mg / dl) compared to the control group (1150 mg/dl). Table (6)

### 3. Discussion

1: The relationship of sex to infection with the parasite *Entamoeba histolytica*

The results of the current study showed a discrepancy in the rates of parasite infection between males and females, where the percentage in females was (71.4) and in males it was (28.6). These results are consistent with previous studies that showed that females are much higher than males. (Tangi et al., 2016) (Chandi & Lakhani, 2020). Another study is consistent with the current study conducted by Almugadam et al, 2021, where it was shown that females are more likely to be infected with intestinal parasites than males (OR = 3.213; P. value = 0.027).

2: Relationship of age group with infection with *Entamoeba histolytica*

For the *E. histolytica* parasite, the highest infection rate was within the age group (less than ten years), which amounted to 48.6%, and the lowest infection rate was within the age group over (40) years, and it was 8.6). These results agree with the study conducted by Ghenghesh et al. 2016), where it was revealed that the age group of 7-10 years are more likely to be infected with intestinal parasites than the age group of more than 10 years. Whereas 2022 Khlaf stated that the highest frequency (38.16) of infection with intestinal parasites was within the age group of 1-10 years. Children at this age are more mobile and active, as well as children's habits of playing in polluted soil in swimming pools or sewers with stagnant water, as well as eating food and ice cream from street vendors, or the reason is due to the acquired immunodeficiency among these children. Anim-Baidoo et al. 2016. Another study, from the city of Derna, examined the presence of intestinal parasites in primary school children aged 6-12 years, selected by systematic random sampling using the master list of eight Sadaga&Kassem schools.

The relationship of sex to infection with the parasite *Entamoeba histolytica* and diabetes mellitus the results of the current study showed a discrepancy in the rates of infection with the parasite between males and females according to the incidence of diabetes, with regard to the *G lamblia* parasite. The percentage in females was (68.2%) and in males it was (31.8%). These results are consistent with the results of the published study, which showed that the frequency of infected females Diabetes was (60.5%) compared to diabetic males, whose frequency was (Hakim et al., 2011 (39.5%). Another recent study showed that intestinal parasites were higher in diabetic females (63.6) than in males (36.4) 2021). Waly et al). Whereas (Mohtashamipour et al. 2015) found that females with diabetes had a higher risk of infection with intestinal parasites compared to males.

(OR=3.06; P , value=0.029) The current study contradicts the results of the study conducted in southern Ethiopia, which revealed that there were no statistically significant differences between the group of people with diabetes and healthy people according to gender and age groups (0.05<Alemu et al., 2018) P). This contradiction may be due to the nature of life in other societies in terms of hygiene and following a health system that avoids high sugar and enhances immunity against infections.

4- Relationship of blood parameters for patients with diabetes mellitus, *Entamoeba histolytica* and diabetes mellitus only the results indicated that there were significant differences (P < 0.05) in the hemoglobin concentration of patients with diabetes who carried a parasite, *E. histolytica*. This means that the hemoglobin concentration of patients with diabetes was significantly lower when compared with the control group. The results of the current study agree with the results of the study conducted in Iraq by Mohammed et al. 2022, where it was found that the hemoglobin concentration of patients with diabetes who were carriers of intestinal parasites was 1.47 + 11.50 compared to 1.22 ± 12.67 for the control group at a probability level of 0.001. A possible explanation for the low hemoglobin concentration could be the possibility that the parasites interfere with the body's ability to absorb nutrients, including iron, which is an essential component of hemoglobin. This can lead to a deficiency in iron and thus a decrease in hemoglobin levels. (2011, Shaw & Friedman). Also, blood loss occurs mostly because the parasite releases a blood clot, causing continued blood loss in the stool, rather than actual blood consumption by the parasite (Steketee, 2003).

In another study conducted by 2019. Drawany et al), who reported that there was a significant difference in hemoglobin level with an average decrease in T1DM patients with opportunistic intestinal parasite infection as opposed to other T1DM patients with non-opportunistic intestinal parasitic infection. The results of this study indicated that hematocrit concentration was significantly lower in diabetic patients carrying intestinal parasites compared to the control group. These results are consistent with the study conducted in Iraq & Hussein AL-MOUSAWI) (Mohammed et al., 2022) (2021, NEAMAH), who found the same results as the current study. The current results may explain, according to our information, that intestinal parasites bleeding in the intestines, which leads to a decrease in PCV as blood volume is lost in relation to WBCS, the study showed that the concentration of white blood cells is significantly higher in diabetic patients carrying intestinal parasites compared to the control group. The current results agree with the study conducted in Najaf (2021), Hussein AL-MOUSAWI & NEAMAH) (Mohammed et al., 2022), where they found that intestinal parasites cause bleeding in the intestines, which leads to a decrease in PCV as blood volume is lost. Intestinal parasites such as *E. histolytica* can also

cause hemolysis, the breakdown of red blood cells. This leads to a decrease in the size of PCV-accumulated cells as A blood cells are destroyed Hamra (Cavagnaro et al., 2006). These differences and effects in proportions are caused by several factors, for example a decrease in hemoglobin and PCV caused by a loss of fluid in the body as a result of the effect of parasitic infection that damages the intestinal villi, which in turn leads to a malfunction in the process of Absorption and excessive excretion, and then erosion of the contents of the intestine, the occurrence of diarrhea and the consequences of diarrhea are among the most important symptoms in infection with intestinal parasites. The patient loses many substances, including fats, sugars, and some vitamins, including vitamin B12, K, D, A and iron (2001). Regarding WBCS, the study showed that the concentration of white blood cells is significantly higher in diabetic patients carrying intestinal parasites compared to the control group. found similar results.

The cause of the white blood increase may be due to the immune system's response to pathogens, especially eosinophils, which play a critical and important role in eliminating parasites. These cells move in large numbers from the bloodstream to the site of parasite infection to adhere to the surface of the parasite and start attacking and killing the parasite (Behm & Ovington 2000). PCV and Hb. The parasites cause digestive problems in patients and thus cause the absorption process, especially since the stages in which the parasites attach to the intestinal villi (CANTOS et al., 2004) regarding WBCS, the study showed that the concentration of leukocytes is significantly higher in diabetic patients carrying intestinal parasites compared to the control group. The current results agree with the study conducted in (2019, Hussein et al.) where he found the same results. The possible cause of the elevated ESR when parasitic infestations may be due to the presence of parasites in the body triggering an immune response, leading to the release of cytokines and other immune system mediators. This can cause inflammation and lead to an increased ESR. 10-5: Relationship of biochemical parameters of diabetes mellitus, *Entamoeba histolytica*, and diabetes mellitus only The results of the current study indicated that there were significant differences ( $P < 0.05$ ), which means that the concentration of blood sugar in diabetic patients carrying *E. histolytica* parasite was significantly higher when compared with the control group. These results agree with the study conducted by (Sisu et al., 2021), where it was reported that 89.5% of patients with diabetes who carried the *E. histolytica* parasite were significantly higher when compared with the control group (19.5%).

Another study conducted by (2022, Njemanze et al.) reported that there is a statistically significant difference in FBS, between diabetic patients ( $78.4 \pm 197.2 = \text{FBS (mg/dL)}$ ) and a non-diabetic group,  $\text{FBS} = 80.5 \pm 12 \text{ F}$ ) (1.93) 93.4,  $P < 0.001$  the effect of

diabetes on attracting intestinal parasite infection may be explained by several reasons that were listed in several studies that indicated that hyperglycemia and dyslipidemia activate inflammatory mediators by ultimately participating in enhancing the chance of developing the type (from DM Rehman & Akash 2016). and reduced immune defense against parasites (Machado et al. 2018). These factors could explain the lower incidence of parasitemia in individuals with type 1 DM, even considering the lower age range of this group of individuals (mostly children and young adults), which would be epidemiologically more susceptible than type 2 DMs who are mostly elderly to parasite infection. (2018), Machado et al. The results of this study indicated that there were no significant differences between diabetic patients carrying intestinal parasites and the control group according to the concentration of cholesterol in the blood. These results are not consistent with the study conducted by (Das 2002, et.al), which stated that cholesterol is a major component of eukaryotic membranes and has an important role in membrane synthesis and function. The results of this study indicated that the concentration of C.R.protein in diabetic patients with *E. histolytica* was significantly higher when compared with the control group. These results are consistent with the study conducted in the province of Baghdad (Al-2015, Ezzy et al.), where similar results were found. The reason behind increased CRP is that intestinal parasites can damage intestinal tissue, causing increased CRP as the body tries to repair the damage (2021, Siddiqui et al). A significant positive increase in the level of C-reactive protein, which may be due to several reasons, one of which may be the large number of infective stages of *E. histolytica* that were ingested, and the long duration of infection causes an increase in the activity of hepatocytes. Increased acute phase reactant synthesis including CRP. On the other hand, tissue damage caused by parasite attachment to the mucosal surface may represent a persistent stimulus for hepatocytes to increase CRP synthesis as an innate defense mechanism that cooperates with increased phagocytic activities of mucosal macrophages in addition to mucosal IgA as a humoral defense mechanism against infectious stages of *E. Histolytica* Safi, 2012).The progression of the immune response plays a role in the negative correlation between the acute phase of diarrhea caused by *E. histolytica* and the level of CRP innate immunity characterizes molecules on the membrane of *histolytica* (2012 Gorczyński).

The results of the current study indicated that the level of B.Urea in patients with diabetes who were carriers of intestinal parasites were significantly higher when compared to the control group. These results are consistent with the results of the study conducted in Iraq. Muhammad et al (2022), which found that the level of B.Urea for patients with Diabetic patients carrying intestinal parasites was (mmol/L 1.63 5.48 vs.  $1.37 \pm 4.98$  and at a probability

level of 0.010. The possible explanation for the high level of urea in the blood may be due to the reasons listed by Mange et al. 1997), where it was shown that since chronic diarrhea has a strong relationship Dehydration as a result of infection with intestinal parasites, which leads to an imbalance in body fluids, especially intracellular and extracellular fluids, causing hypovolemic shock and organ damage, in particular, with a high level of urea in the blood called uremia due to pre-kidney disease. The results of the current study indicated that there were significant differences ( $P < 0.05$ ) in the concentration of HbA1C in patients with diabetes who carried the *E. histolytica* parasite, and when compared with the control group, the results of this study agree with Drawany et al 2019, who reported that there is a significant difference in the level of HAIC ( $P > 0.001$ ) present higher in T1DM patients with opportunistic intestinal parasitic infection than in other diabetic children with non-opportunistic intestinal parasitic infection. There are many reasons why HbA1C may increase, including Parasitic infection can lead to malabsorption of nutrients and decreased insulin secretion, leading to increased HbA1c levels. Parasitic infections can also alter hormone levels in the body, leading to changes in glucose metabolism and increased levels of HbA1c (Khanna et al., 2022) (Rajamanickam et al., 2019).

Although there were no significant differences between diabetic patients carrying intestinal parasites and control group with respect to S.H.D.L., however, there were many studies that showed a significant increase in HDL in blood in patients infected with *E. histolytica*. compared to the control group 2015), Feingold & Grunfeld 2022, Al-Hadraawy et al., 2016 (Pirillo et al). The possible explanation for the lack of significant differences may be that other factors affecting SHDL such as diet, exercise, genetics and general health may also play a role in determining HDL levels, making it difficult to determine the direct effect of intestinal parasite infection. The study reported that there were no significant differences between diabetic patients carrying intestinal parasites and the control group with respect to S. creatinine and S. uric acid. There may be several reasons that prevented a significant relationship, and either there are many factors that can affect creatinine and uric acid levels, such as diet, exercise, medications, and underlying medical conditions, or the duration of the parasite infection may not be long enough to affect creatinine levels. and uric acid.

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