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Prevalence of intestinal parasites among diabetic patients (T1DM,T2DM) in AL-Diwaniyah City / Iraq

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Summary

The current study, which was conducted in the city of Al-Diwaniyah / Iraq, included examining 132 random stool samples from people suffering from diabetes, for the age groups 20-50 years and for the T1DM and T2DM, and from different places represented by the Diabetes Center and the Al-Diwaniyah Teaching Hospital, for both sexes (61 males, 71 females). For the purpose of knowing the prevalence of intestinal parasites in diabetic patients, also based on filling out a questionnaire for each patient in this study.

The results of the current study showed that the number of diabetic patients who had a positive diagnosis of intestinal parasitic infection reached 54 out of 132 patients investigated using microscopic examination, i.e. an infection rate of 40.9% [males 24 (44.4%), females 30 (55.6%)]. . The prevalence of intestinal parasites according to the type of diabetes was as follows: 20 (37.0%) T1DM and 34 (63.0%) T2DM. The results of the statistical analysis also showed that there was a significant difference in the prevalence of intestinal parasites according to the type of diabetes. While the frequency distribution of diabetic patients with parasitic infections was as follows: 34 (63.0%) parasitic protozoan infections, 20 (37.0%) helminth infections ,It is worth noting that *E. histolytica* infection was recorded at a higher frequency compared to other parasitic infections in both patients with T1DM and T2DM, with a prevalence rate of 37.0%. The results of the statistical analysis also showed that there was a significant difference in the type of frequency distribution of parasitic infections in diabetic patients. As for age groups, the current results showed that a high percentage of patients with a positive parasitic infection were in the age group >40 years, with 33 (61.1%). As for the gender of the patient, the current results showed that a high percentage of patients suffering from a positive parasitic infection were of the female gender, 30 (55.6%). The results of the statistical analysis showed that there was a significant difference in infection with age group, as well as a significant difference also in gender.

Keywords: Intestinal parasite, Diabetes, T1DM, T2DM .

Introduction

Intestinal parasite incidence and prevalence are widely known in many different civilizations, and mounting evidence suggests a potential link between intestinal parasites and a range of diseases, including diabetes, Numerous studies have found that the frequency of intestinal parasites is higher in diabetic patients than in non-diabetic people **(1)**.

Intestinal parasite infections have a prevalence rate of 30–60.0% and are extremely harmful to people's health as well as the health of the public, particularly in developing countries. Moreover, these parasites are responsible for a serious health problem that affects the economy, especially in developing countries in tropical and subtropical areas. Intestinal parasite infections affect over 3.5 billion people globally; 450 million of those patients have symptoms, and each year more than 200,000 fatalities are documented **(2)**.

Diabetes is a chronic metabolic condition that affects millions of individuals worldwide and is characterized by persistent hyperglycemia. According to estimates from the International Diabetes Federation, 463 million people worldwide have diabetes in 2019, and by 2045, that number is expected to rise to 700 million **(3)**.

It is yet unclear what possible processes could underlie the link between intestinal parasites and diabetes. The impaired immunological response seen in diabetics is one hypothesis that could apply. Immune function is known to be compromised by diabetes, leaving people more prone to infections and less able to properly get rid of parasites. Moreover, people with diabetes may have altered gut microbiota compositions that promote an environment favorable to parasite colonization and growth **(4)**.

A collection of metabolic illnesses collectively known as diabetes mellitus (DM) are typified by persistent hyperglycemia, which can be brought on by decreased insulin secretion, action, or both. Diabetes-related chronic hyperglycemia causes harm, malfunction, and failure to a number of organs, including the heart, blood vessels, kidneys, eyes, and nerves **(5)** .

Although the inability of control blood glucose levels and the resulting chronic hyperglycemia are the definition of "diabetes," two main clinically different subgroups have historically been identified. The full autoimmune-mediated death of the beta (β)

cells that produce insulin within the pancreatic islets is the cause of type 1 diabetes (T1D) **(6)**. On the other hand, type 2 diabetes (T2D) results from an inability of the β-cell population to meet the demand for insulin and/or from peripheral tissues' resistance to insulin's effects **(7)**.

By 2045, it is predicted that 537 million people worldwide—or one in ten adults—would have diabetes mellitus, a number that will have increased to 783 million. Diabetes increases the risk of diabetic foot complications, such as infection, ischaemia, and peripheral neuropathy, significantly. These variables, along with elevated biomechanical stress and trauma, are crucial in the development of a foot ulcer; in people with diabetes, the lifetime incidence of such an ulcer can reach 34% **(8)** .

Various studies have found varying global prevalences of intestinal parasites in persons with diabetes. Different prevalence rates have been reported in studies, including An Odds Ratio of 1.72 indicated a significant correlation between the occurrence of IPs in diabetic cases and non-diabetic controls. According to the study, 26.5% of diabetic individuals had a pooled prevalence of intestinal parasites (IPs). Geographically, the Americas showed the highest incidence of intestinal parasites (IPs) among patients with diabetes (13.3%), indicating geographical differences in the prevalence of intestinal parasites among people with diabetes **(9)** .

Materials and methods :

Collection Stool Samples

132 stool samples were collected from diabetics aged between 20-50 years of both sexes, males and females, The patient's information was obtained by filling out a questionnaire that includes the date of collection, gender, age, type of treatment used, date of onset of diabetes, as well as asking about some clinical symptoms, in addition to other information, where microscopic examination was carried out after receiving the samples and within a period not exceeding two hours.

General Stool Examination

The microscopic examination was carried out using methods including direct smear, precipitation method and flotation method depending on **(10,11).**

Results and Discussion

Prevalence of intestinal parasite among DM

The present study enrolled 132 samples from patients with DM with age range (20-50) years were investigated for intestinal parasites using microscopic examination. The present study show 54 (40.9%) of sample have positive diagnosis of parasite infection out of 132 patients with DM, as shown in table (1-1).

Table (1-1): Percentages of total infection with intestinal parasite among DM

Examined number	Infected numbers	Frequency
132	**54**	**40.9%**

These results are similar to the results of another research in the Egypt country, that indicated to prevalence of intestinal parasites in diabetics with an incidence rate of 44% **(12)** . The researcher **(13)** also reported that out of 156 diabetics, 64% of them are infected with intestinal parasites . Another search In Nigeria, diabetics showed a prevalence of 25.3% of intestinal parasitic infections and 15.8% of malaria infections, with a co-infection rate of 4.2**% (14)**. Research conducted in India revealed that intestinal parasitic infections were common in diabetics, with a prevalence of 14.36%. The most isolated parasite among diabetic patients was *E. histolytica*, according to various studies that shed light on the prevalence and types of parasitic infections among individuals with diabetic patients **(15)**. The study also revealed that the frequency of intestinal parasites in diabetic patients is higher in Asian nations (17.6%) than in African nations (13.3%), suggesting that regional variations in infection may exist **(16)**.

The present study reports on the overall intestinal parasite infection rates, which show both convergence and variation when compared to the previously mentioned studies. These variations may be ascribed to various factors such as the environments and regions from which the samples were collected, sample size differences, study period, and potential differences in living, nutritional, and health conditions. The discrepancy in age groups, the quantity of samples analyzed, and the testing methods could possibly be to blame. This discrepancy is linked to diabetes's weakened immune system, which makes people more vulnerable to infections.

Frequency distribution of diabetics patients with parasitic infection according to type of DM and parasite

The frequency distribution of diabetics patients with parasitic infection according to type of DM and parasite are shown in table (1-2). The frequency distribution of diabetics patients with parasitic infection according to type of diabetics was as following: 20 (37.0 %) of patients have type 1 diabetics and 34 (63.0 %) of patients have type 2 diabetics.

The frequency distribution of diabetics patients with parasitic infection according to type of parasitic infection was as following: 34 (63.0 %) of diabetics patients with protozoa infection, 34 (63.0 %) of diabetics patients with Helminthes infection.

Table (1-2): The frequency distribution of diabetics patients with parasitic infection according to type of DM and parasite .

Characteristic	Diabetics patients with parasitic infection *n* (%)
Type of diabetics	
T1DM *n* (%)	20 (37.0 %)
T2DM , *n* (%)	34 (63.0 %)
Type of parasitic infection	
Protozoa, *n* (%)	34 (63.0 %)
Helminthes, *n* (%)	20 (37.0 %)

These results are agree to the findings of Machado whose showed the Individuals with type 2 diabetes show higher frequencies parasitic infections compared to type 1 diabetes, possibly due to different immune responses and inflammatory profiles . Among individuals showing T1D, 62% (74/120) were infected with protozoa and helminthes, whereas 78% (28/36) of that showing T2D were infected **(13)** .

Also agree, with the study in Egypt among type 1 diabetic patients The rate of parasitic infection was (27%) overall From all infected children intestinal protozoal infections were higher than helminthic ones 64% and 22% respectively **(17) .** Patients with type 2 diabetes mellitus in Benghazi, Libya, showed a higher prevalence of intestinal parasitic infections compared to non-diabetic individuals, with specific parasites like *E. coli* and *C. parvum* being more common. **(18)** .

Patients with type 1 diabetes (T1DM) and parasite infections have been found to have a complex association. Research indicates that parasitic infections may delay the onset of T1DM through mechanisms involving immune response modulation and macrophage polarization. All things considered, the complex interactions between parasite infections

and type 1 diabetes (T1DM) that involve immune responses, macrophage functions, and possibly even bidirectional links call for more research to fully understand their effects on diabetic patients **(19) .**

Although the data overwhelmingly favors the idea that people with type 2 diabetes are more likely to contract parasites, it is important to remember that people with type 1 diabetes may still be at risk, albeit perhaps less so because of their immune profiles. To fully investigate these processes, more study is required.

The association between microscopic examination finding and age group and gender .

The comparison of age group distribution according to results of light microscopic examination for intestinal parasite is shown in table (1-3). The present results show high rate of patients with positive parasitic infection have higher than 40 years age group, 33 (61.1%). Regarding gender, the present results show high rate of patients with positive parasitic infection was female gender, 30 (55.6%).

Table (1-3): Association between light microscope finding and age group .

Characteristic	Examined number	Positive results *n* = 54
Age (years)		
Mean ±SD		39.98 ± 8.83
Range		20–50 years
< 30 years, *n* (%)	27	8 (14.8%)
30-39 years, *n* (%)	22	13 (24.1%)
≥ 40 years, *n* (%)	83	33 (61.1%)
P value	0.004	
X^2	11.111	
Gender		
Male, *n* (%)	61	24 (44.4 %)
Female, *n* (%)	71	30 (55.6%)
P value	0.057	
X^2	3.630	

n: number of cases;

This result is consistent with a study was conducted in Najaf / Iraq the results also showed that most of infected patients were in the age between 41-60 years (13.3%) and 61- 80 years (7.8%), This is due to the weak immune system associated with ageing in diabetes . The results also showed a significant higher infection in females (57.6%) compared to males (42.3%) may be females are more mobile than males, and works in agricultural and other domestic work, which exposes them to more parasite infections, The sexdependent distribution of intestinal parasitic infections depends on several cultural, social and environmental factors, which in turn differ from one region to another, and thus these discrepancies are expected from one study to another **(20)** . In diabetic patients there is 37.46% patients in the age group 21-40 years, 34.61% patients between 41-60 years, and 19.34% patients above >60 years were infected with intestinal parasites **(1)** . Also the present results agree with the results study in Babil city the results of 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%) respectively **(21)** .

Distribution of intestinal parasite species detected in fecal samples of individuals with type 1 diabetes (T1DM) and type 2 diabetes (T2DM) .

The frequency distribution of intestinal protozoa and helminthes detected in fecal samples of individuals with type 1 diabetes (T1DM) and type 2 diabetes (T2DM) was shown in table (1-4) . In the present study, *E. histolytica* infection was higher frequency in compared with other parasite infections in both patients with T1DM and T2DM .

Table (1-4): Distribution of intestinal parasite species detected in fecal samples of individuals with type 1 diabetes (T1DM) and type 2 diabetes (T2DM) .

Parasite species	Total	T1DM *n=20*	T2DM *n=34*	*P*
***Entamoeba histolytica*, *n* (%)**	20 (37.0%)	7 (35.0%)	13 (38.2%)	0.987
***Giardia lamblia*, *n* (%)**	11 (20.4%)	6 (30%)	5 (14.7%)	0.142
***Entamoeba coli*, *n* (%)**	4 (7.4%)	1 (5.0%)	3 (8.8%)	0.765
***E. Vermicularis*, *n* (%)**	8 (14.8%)	1 (5.0%)	7 (20.6%)	0.233
***Hymenolepis nana*, *n* (%)**	4 (7.4%)	1 (5.0%)	3 (8.8%)	0.628

***Taenia*, *n* (%)**	3 (5.6%)	3 (15.0%)	0	0.061
***Ascaris lumbricoidis*, *n* (%)**	4 (7.4%)	1 (5.0%)	3 (8.8%)	0.628
Total	54 (100.0%)	20 (100.0%)	34 (100.0%)	

n: number of cases; ¥: Chi-square test; *: significant at P < 0.05

This result is agree with a study was conducted in AL-Najaf / Iraq showed that the most prevalent types of intestinal parasites are *E.histolytica*, with a percentage of (34.3) and *G. lamblia* ranked second with prevalence rates in both type of diabetic patients, with a rate of (28.4) and (23%) respectively . Also, there were other intestinal parasites, such as *A. lumbricoides*, *T. vaginals*, *C. parvum* and *T. gondi* **(20)** . And agree with the findings of **(22)** regarding prevalence of the intestinal parasites in diabetic patients (10%) with *E. histolytica* as most common intestinal parasite .

(15) reported the parasitic infections with the most common parasite isolated from the stool samples was *E. histolytica*, with a prevalence of 5.32% among the diabetic patients studied Following *E. histolytica*, *A. lumbricoides* was the second most common parasite isolated, with a prevalence of 4.79% in the study population , *G. lamblia* was the least isolated parasite among the diabetic patients, with a prevalence of 3.19% in the study sample, also agree with the present study.

There are differences in the severity of infection and prevalence of intestinal parasites, whether they be worms or parasitic protozoa, between research studies due to different study periods, variations in the total number of patients sampled, variations in the climatic conditions of different countries, variations in the parasite's epidemiology and spread from place to place, and variations in the host's immune response and defense mechanism against the parasite.

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