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# Intestinal Parasitic Infections among Patients with Type 2 Diabetes Mellitus in Benghazi, Libya

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## Abstract

*Diabetes is becoming a major chronic disease burden all over the world. Little is known about the prevalence of intestinal parasitic infections in them. The aim of this study was to determine this prevalence in type 2 diabetes mellitus in Benghazi, Libya. A cross sectional case control study recruited two hundred type 2 diabetics from Benghazi diabetic center and one hundred non-diabetic individuals which served as control group was taken from Benghazi medical center and Elhiaa clinic .Their ages ranged between 18 to 55 years with and without diarrhea between January and December 2016. Socio demographic characteristics were taken during the interview. Fresh stool specimens were collected and processed, and data was analyzed. The prevalence of intestinal parasites was higher among diabetic patients (40.0%) than amongnon diabetic patients (16.0%).Specifically, the following intestinal parasites were highly prevalent in diabetic subjects Entamoeba coli (10.5%), Cryptosporidium parvum (8.5%), while in control group Entamoeba histolytica (10%), Ascaris Lumbricoides (3%) were the most isolated parasite. There was a significant relationship between prevalence of parasite and diarrhea (p=0.001), education (p=0.000), single and multiple infections (p=0.001). Relation was not significant between parasitic infections with sex and age in all sample (p=0.203, p=0.56) respectively .The present study emphasizes the necessity of increasing awareness among clinicians regarding the occurrence of intestinal parasites at higher prevalence in type 2 diabetic patients.*

**Keywords:** Intestinal Parasites, Diabetes Mellitus, Benghazi, Libya

## Introduction

Intestinal parasites are two main types namely helminthes and protozoa which are important causes of infections in immunocompromised individuals. In healthy individual usually they cause less aggressive disease. It's a public health problem especially in tropical countries where poor sanitary conditions and contamination of food and water sources [1]. The developing countries are more prone to intestinal and extra-intestinal parasitic diseases [2]. Even in well developed area some of these parasites can cause significant disease in immunocompromised patients and young children [3-4]. About 340 parasites infect an estimated 3.5 billion persons and cause clinical signs and symptoms in approximately 450 million [5-6]. Any weakness or defect in immune system including chronic internal diseases and metabolic disorders can lead to increases the risk of establishment of the infection, chronic carriage states, and morbidity of the intestinal parasites. Diabetes mellitus is one of these metabolic diseases which can affect immune system. Diabetic patients have been reported to be immunocompromised which predispose them to many of infection including parasitic infection [7-10]. The prevalence of the diabetic patients infected with intestinal parasite in our Country is almost undetected and the efficacy of the treatment or preventive methods are obscure that's why we conduct this study to determine the burden of parasitic infection in both diabetic comparing to non diabetic Benghazi population.

## Materials and Methods

### Study Design and Patients

A cross sectional case control study recruited two hundred type 2 diabetics (134 females and 66 males) from Benghazi diabetic center and one hundred non-diabetic individuals (73 females and 27 males) which served as control group was taken from Benghazi medical center and Elhiaa clinic their ages ranged between 18 to 55 years with and without diarrhea between January and December

2016. Socio demographic characteristics were taken during interview. Fresh stool specimens were collected and processed. The glycated hemoglobin (HbAlc) was measured to detect DM in control group.

**Specimen Collection and Processing**

All individuals in this study were interviewed by using a questionnaire. Stool samples were collected in a dry, clean, leak-proof plastic container were transported to the research laboratory of Institute Medical Professions_ Benghazi immediately. Half of each sample was stored in 10% formalin to prevent bacterial action [11]. These samples were examined macroscopically by naked eye for appearance, color, consistency and presence of blood mucous and adult or larvae helminthes [12] microscopically following direct and formalin-ether concentration method [13]. Direct microscopy of the smears in a saline (0.85% NaCl solution) to confirm the presence of motile intestinal parasites and trophozoites under light microscope (40x magnifications) and Lugol's iodine was performed for the detection of ova, larvae, trophozoites and cysts of intestinal parasites. In addition, a concentration procedure was employed that involved mixing the stool samples with formalin, treating with ether, centrifuging afterwards to increasing the chance of detecting protozoan parasite oocysts. The layers of ether, formalin, and debris were discarded and the residues were used to investigate for the presence of intestinal parasites [13-14]. Also, we used modified Ziehl-Neelsen staining technique fordetection of oocysts of opportunistic coccidial intestinal parasite Cryptosporidium spp, Isospora belli and Cyclospora cayetanensis [15]. The data was analyzed using SPSS version 17 statistical package. A comparison of the frequency of parasites betweencases and controls was performed by chi-square test.

## Results

Prevalence of intestinal parasites was 40.0% among diabetic higher than non-diabetic 16.0% with high significance ($\chi^2$=37.576, df=10, p=0.000). Figure 1 show this prevalence in diabetic and non-diabetic participant. Specifically, the following intestinal parasites were highly prevalent in diabetic subjects Entamoeba coli (10.5% of 200 total diabetic/26.3% of infected diabetic patients), Cryptosporidium parvum (8.5% of 200 total diabetic/21.3% of infected diabetic), while in control group Entamoeba histolytica (10% of 100 total non-diabetic/63% of infected non diabetic), Ascaris lumbricoides (3% of 100 total non-diabetic/19% of infected non diabetic) were the most isolated parasite. Table 1 show different types of parasite isolated from diabetic and non-diabetic control and their percentage (calculated from total infected number).

**Table1:** Prevalence of different intestinal parasitic infection among infected DM and non DM control

| Type of parasites | Infection (%) | |
|---|---|---|
| | Patients with DM (n=80 ) | Control (n=16) |
| Blastocystis hominis | 1.3 %(1) | 6.3 %(1) |
| Entamoeba histolytica / E. dispar | 12.5% (10) | 63.0 %(10) |
| Giardia lamblia | 12.5%(10) | 13 %(2) |
| Entamoeba coli | 26.3% (21) | 0 %(0) |
| Cryptosporidium parvum | 21.3% (17) | 0 %(0) |
| Entamoeba hartmanni | 11.3% (9) | 0 %(0) |
| Isospora belli | 6.3% (5) | 0 %(0) |
| Dientamoeba fragilis | 3.8% (3) | 0 %(0) |

The relation between the diabetes status and the risk parasitic infection was strongly significant ($\chi^2$ =17.64, df=1, p=0.000, odds ratio=3.5, CI=1.94-6.4). There was a significant relationship between prevalence of parasite and history of diarrhea ($\chi^2$ =26.5, df=1, p=0.000, Odds ratio 5.94, CI=2.84-12.4) as general and as separate for diabetic (p-value =0.001) and non diabetic (p- value =0.000).

**Table 2:** Numbers of patients with positive and negative infection as regard to history of diarrhea

| Diarrhea | Total examined (n=200) DM | With parasitic infection (n=80) | Total examined (n=100) Non DM | With parasitic infection (n=16) |
|---|---|---|---|---|
| With diarrhea | 4(100%) | 4 | 22 (65.0 %) | 34 |
| Without diarrhea | 12(12.5%) | 96 | 58 (35.0%) | 166 |
| Total | 16 | 100 | 80 | 200 |

The effect of education level was remarkable i.e. people with high education level they have less risk of parasitic infection ($\chi^2$ =117.95. df=2, p value = 0.000) regardless of diabetes status. The relation of the gender ($\chi^2$ =1.62 df=1, p value =0.203, odds ratio 0.7 CI = 0.4-1.2).and age ($\chi^2$ =1.21 df=2, p value =0.56) in general to the risk infection with parasite was not significant except in non diabetic population were the risk increase with age ($\chi^2$ =13.3, df=2, p=0.001) and being female sex ($\chi^2$ =4.1, df=1, p=0.04).

**Table 3:** Prevalence of intestinal parasitic infection in each age group among diabetic and non-diabetics

| Age groups (years) | DM | | Control | |
|---|---|---|---|---|
| | Examined (n=200) | Infected (%) (n=16) | Examined (n=100) | Infected (%) (n=40 ) |
| 20-29 | 63 | 28 (44.4%) | 28 | 5(17.9%) |
| 30-39 | 97 | 41 (42.3%) | 37 | 0(0 %) |
| >40 | 40 | 11(27.5%) | 35 | 11(31.4%) |
| Total | 200 | 80(40%) | 100 | 16(16.0%) |

Single or multiple infections was strongly correlated with diabetes status ($\chi^2$ =39.46. df=2, p= 0.000), education level ($\chi^2$ =147.8, df=4, p=000) being markedly lower with higher education to get multiple infection, age ($\chi^2$ =52.37, df=4, p value = .000), and gender ($\chi^2$ =15.45, df=2, p=0.000) (female have higher risk of multiple infection) and history of diarrhea ($\chi^2$ =33.98, df=2, p= 0.000) is highly positive with multiple infection.

**Table 4** shows duration of DM comparison between intestinal parasitic infections and duration of type 2 diabetes in patients. This study showed that the highly statistically significantly (p=0.001) between the Duration of DM with the intestinal parasitic infections. ($\chi^2$=40.212, df=1, p=0.001).

**Table 4:** Duration of type 2 diabetes in patients and parasitic infections

| Total | Parasitic negative | Parasitic positive | Duration of DM (year) |
|---|---|---|---|
| Less than 5 year (n=105) | 30\105 (28.6%)<br>30\80 (37.5%) | 75 | 105 |
| ≥5 (n=95) | 50\95 (52.6%)<br>50\80 (62.5%) | 45 | 95 |
| Total | 80 | 120 | 200 |

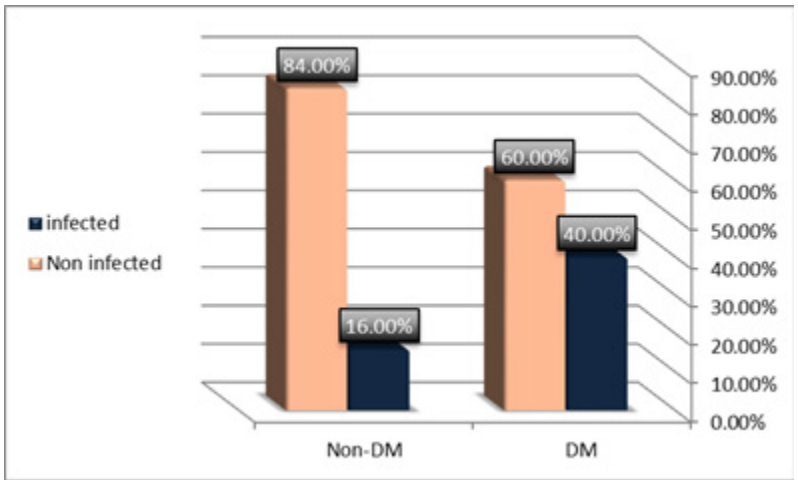


**Figure 1:** Show prevalence of parasitic infection in diabetic and non diabetic participatent

## Discussion

The prevalence of parasitic infection in our study was 40 % in diabetics which significantly higher than in non diabetic 16%, this result were in concordance with some previous studies. Mohtashamipour M, et al. 2015 [16], their study in Iran reveal that the rate of parasitic infection in diabetics was 26.3% which is higher than control 6.8%. Also in agreement with Olusegunet al. 2013 which could be explained by the defect in immune response in diabetic patients [17]. In contrast Fominyam Boris Tangietal 2016 at Cameroon and Nazligul et al 2001 at south east turkey, their studies show lower prevalence of parasitic infection among diabetic (10%, 47%) comparing to non diabetics (23.5%, 55.9%,) respectively. They explained their result by fact that the greater number of physician visits incurred by diabetic patients than the non-diabetic patients where diabetic patients consult frequently and are treated for possible intestinal parasitic infections [18-19]. Of note both last studies were conducted at areas known to have high parasitic infection rate. While Olusegun et al 2013 conduct the study at area with lower rate of parasitic infection. So it seems in areas were endemic for parasite the effect of diabetes attenuated.

The relation between the diabetes status and the risk of parasitic infection was strongly significant in our study (OR= 3.5) i.e. the diabetes increases the risk of parasitic infection which in agreement with result of Mohtashamipour M, et al. 2015 but in contrast with result of Fominyam Boris Tangietal 2016 and Nazligul et al 2001 which show lower risk with diabetes [20]. Some previous studies show no difference as regard to sex, age and this in concordance with our result for all sample (p value =0.203) and in diabetics. While many studies show that female and older ages have higher prevalence of parasitic infection this similar to our result for non diabetic (P value =0.04for sex, p value =0.001 for age). So it seems diabetic status attenuate the effect of age and sex on the risk of acquiring parasitic infection [21]. Lower education level and positive history of diarrhea was strong predictor for parasitic infection especially mixed infection and this in agreement with some of previous studies.

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