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**PREVALENCE OF INTESTINAL PARASITES AMONG DIABETIC PATIENTS  
ATTENDING SOME HOSPITALS IN KADUNA METROPOLIS, KADUNA  
STATE, NIGERIA**

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**ABSTRACT**

A parasite is an organism that resides on or within another living organism (the host), in order to find the environment and nutrients required for its own growth and development. Diabetes Mellitus (DM) is recognized as being a syndrome, a collection of disorders that have hyperglycaemia and glucose intolerance as their hallmark. This study was conducted to evaluate the prevalence of intestinal parasites among patients with diabetes attending some hospitals in Kaduna metropolis. A total of 320 individuals, this include 260 (99 males and 161 females) DM patients and 60 (12 males and 48 females) Non-DM individuals attending some hospitals in Kaduna were used for this study. Stool specimens were collected from diabetic patients and processed based on standard techniques to detect intestinal parasites. An overall prevalence of 21.9% of intestinal parasitic infections among DM patients was observed in this study. *Ascaris lumbricoides* (23/62, 37.1%), *Entamoeba coli* (17/62, 27.4%), *Entamoeba histolytica* (9/62, 14.5%), *Enterobius vermicularis* (1/62, 1.6%), *Giardia lamblia* (1/62, 1.6%), Hookworm species (6/62, 9.7%), *Schistosoma mansoni* (1/62, 1.6%), *Strongyloide stercoralis* (2/62, 3.2%), and *Taenia* spp (2/62, 3.2%) were recovered from DM patients. Age, level of education and occupation were significantly affected the intestinal parasitic infections in DM patients at p value of p = 0.013; p = 0.009 and p = 0.031; respectively. In this study, 25% Type I DM and 22.2% Type II DM patients were infected with intestinal parasites, while 21.4% and 24.2% of the low and middle income DM patients respectively were infected with intestinal parasites.



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Diabetes Mellitus patients are advised to prevent intestinal parasitic infection, routinely screen for intestinal parasites, frequently de-worm and treat intestinal parasites.

**Keywords:** Parasites, diabetic patients, infection, *Entamoeba histolytica*, nutrients

### INTRODUCTION

Parasitic infections are among the most widespread of all chronic human infections worldwide. They affect an estimated 3.5 billion persons and cause clinical morbidity in approximately 450 million people (Abiye *et al.*, 2019). Intestinal parasitic infections continue to be a significant health problem in both developed and developing countries (Akinbo *et al.*, 2013). Opportunistic infections vary according to the geographical location as well as the endemicity in such location (Akinbo, 2013). Protozoa and helminthes are among the most important pathogens that can cause infections in immunocompromised individuals (Abiye *et al.*, 2019). These microorganisms are capable of infecting individuals with impaired cellular immunity (Abiye *et al.*, 2019). Emerging intestinal parasites have gained increasing attention as important opportunistic pathogens responsible for clinically important infections in immunocompromised patients (Akinbo *et al.*, 2013).

Diabetes Mellitus (DM) is a metabolic disorder of chronic hyperglycemia characterized by disturbances to carbohydrate, protein, and fat metabolism resulting from absolute or relative insulin deficiency with dysfunction in organ systems (WHO, 1999). It is a widely distributed disease, with a rapidly increasing prevalence in various populations (Akinbo *et al.* 2013). Populations previously unaffected or minimally affected by Diabetes mellitus are now reporting soaring prevalence figures, which poses a real challenge to fund available to health by governments and nongovernmental organizations (Andrew *et al.* 2018).

The prevalence of intestinal parasitic infections among DM individual was studied in Owo, Ondo state, Nigeria by Akinbo *et al.* (2013), Tangi *et al.* (2016) in Cameroon, Nazligul *et al.* (2001) and Waly *et al.* (2021) in Egypt. There is no report on the prevalence of intestinal parasitic infections among DM patients in Kaduna State, Nigeria. Therefore this study was



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carried out to evaluate the prevalence of intestinal parasitic infections among diabetes patients in Kaduna metropolis.

### MATERIALS AND METHODS

#### Study Area

This study was carried out in Kaduna metropolis, North west, Nigeria. Kaduna is the capital of Kaduna State. It is located between latitudes  $10^{\circ} 22' 00'' - 10^{\circ} 40' 00''$  N and longitudes  $7^{\circ} 20' 00'' - 7^{\circ} 28' 00''$  E. The metropolis occupies an area of about 260km<sup>2</sup>, and the distance between the eastern and western limits of the city is approximately 13.7km though this keep changing as development increases. It is made up of two Local Government Areas (Kaduna North and Kaduna South) and some part of Igabi and Chikun Local Government Areas. (Adewuyi, 2008).

#### Study Population

1. A total of 320 participants were recruited for this study. This include 260 (99 males and 161 females) DM patients attending selected hospitals in Kaduna metropolis and 60 (12 males and 48 females) non-DM individuals. The age of the study participants ranged from 20-69 years. The DM participants were controlled patients who attended selected hospital—(Sabo general Hospital Chikun Local Government Area, Yusuf Dantsoho Memorial Hospital, T/Wada , Kaduna South Local Government Area, Rigasa general Hospital Igabi Local Government Area, Federal Staff Clinic, Federal Secretariat, Kawo, Kaduna North Local Government Area.) in Kaduna metropolis for routine checkup (Akinbo *et al.*, 2013). Informed consent was obtained from each participant (with 83.3% acceptance rate) before stool specimen collection. The protocol for this study was approved by the Ethical Committee of Kaduna state Ministry of Health.



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### **Stool collection and Processing**

Stool specimens were obtained in a clean wide-mouthed container from each participant in both the case and control groups. The samples were processed using the Formol-ether concentration method and examined microscopically for intestinal parasites (Akinbo *et al.*, 2013).

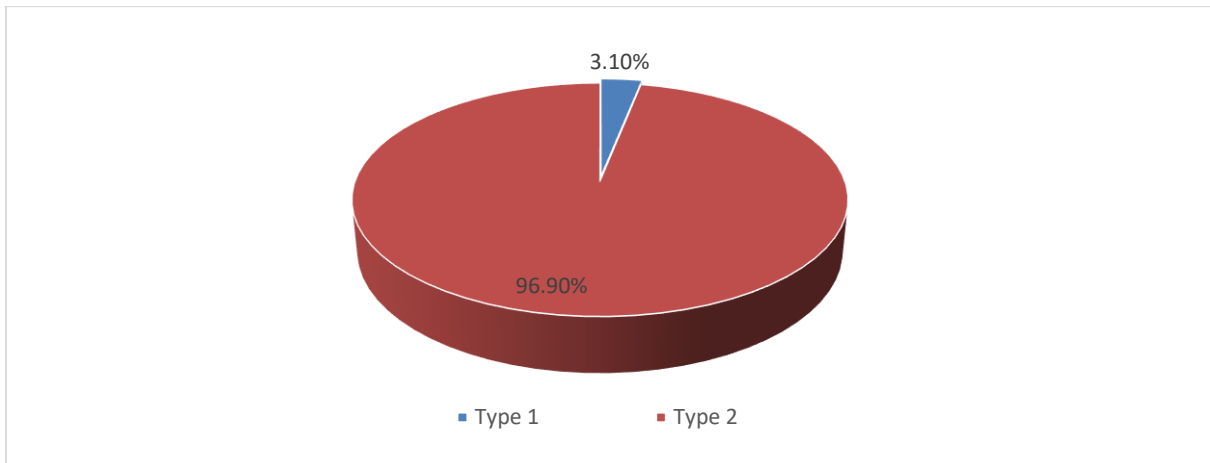
Faeces sample (1g) was placed into 7mls of 10% formalin solution in a tube and mixed well. The emulsified faeces were sieved using cotton gauze and the suspension collected into a centrifuge tubes, 3mls of diethyl ether was added to the suspension in the centrifuge tube, capped and mixed well. It was centrifuged immediately at 3000 revolution per minute. A sterile stick was used to loosen the layer of faecal debris from the side of the tube and the supernatant was discarded and the sediment was examined microscopically (Cheesbrough 2005).

### **Data Analysis**

The data obtained were analyzed using chi-square to compare frequency data. The Odd Ratio (OR) was calculated for potential risk factor. GraphPad InStat software was used for statistical analysis (Akinbo *et al.*, 2013).

## **RESULTS**

The results on status and types of *Diabetes mellitus* of participants obtained from the studied population are presented in Figure 1. It showed that 3.1% of the total surveyed population were having Type 1 DM while 96.9% were having Type 2 DM.



**Figure 1: Status and Type of Diabetes Mellitus in participants.**

Result presented in Table 1 showed the intestinal parasitic profile of participants according to their DM class. It showed that 22.2% of the Type II DM participants were infected with intestinal parasites, while 25% of the Type I DM participants were infected with intestinal parasites.

**Table 1: Intestinal Parasitic infection among Types of Diabetes mellitus individuals.**

DM STATUS	NUMBER TESTED	NUMBER INFECTED	PERCENTAGE INFECTED
<b>TYPE II DM</b>	252	56	22.2
<b>TYPE I DM</b>	8	2	25

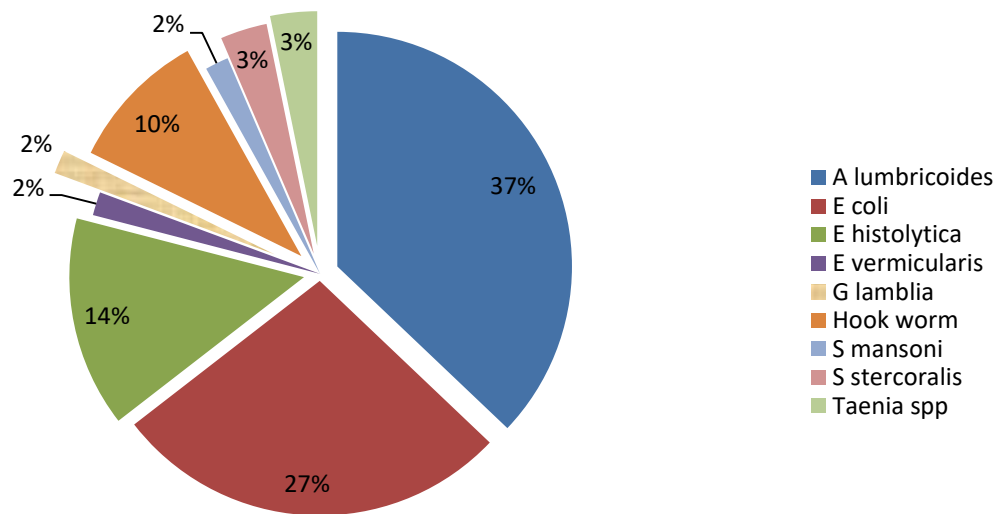
Key: DM= Diabetes Mellitus, %= Percentage.

Parasites such as *Ascaris lumbricoides*, *Entamoeba coli*, *Entamoeba histolytica*, *Enterobius vermicularis*, *Giardia lamblia*, *Hookworm*, *Schistosoma mansoni*, *Strongyloides stercoralis*,



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and *Taenia spp* were recovered from DM participants. Only one case each of hookworm species and *E. histolytica* infection each was observed among type 1 DM participants. *Ascaris lumbricoides* infection was the most prevalent (37.1%), followed by *Entamoeba coli* (27.4%), *Entamoeba histolytica* (14.5%), *E. vermicularis* (1.6%), *G. lamblia* (1.6%), *Hook worm* (9.7%), *S. mansoni* (1.6%), *S. stercoralis* (3.2%), and *Taenia spp* (3.2%) as showed in Figure 2.



**Figure 2: Intestinal Parasite associated with Diabetes mellitus patients.**

The results of intestinal parasitic profile of DM and Non-Dm in this study were presented in Table 2. It showed 21.9% of DM participants were infected with intestinal parasites, while 3.3% of the Non-DM (Control) group was infected with intestinal parasites.



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Table 2: Intestinal parasitic profile of Individuals in the diabetic (case) group and non-diabetic (control) group in the surveyed population

DM STATUS	NO. TESTED	NO. INFECTED	% INFECTED
DM PATIENTS	260	57	21.9
NON DM PATIENTS	60	2	3.3

Key: DM= Diabetes Mellitus, %= Percentage.

Results on intestinal parasitic profile of DM participant in the entire population surveyed in relation with their Income Status were collated from questionnaire administered to the participants and presented in Table 3. It showed that 65% of the DM participants were Low income earners, while 35% were middle income earners. The distribution of intestinal parasitic infection among DM participants in relation to their income level was presented in Table 3. It showed that 21.4% of the low income participants were infected with intestinal parasites while 24.2% of the middle income participants were infected with intestinal parasites. There were no participants of high income status. There was no significant statistical relationship between income status and parasitic infections among DM patients. (OR = 1.1349; 95% CI = 0.5866-1.9030; p = 0.3047).

**Table 3: Intestinal parasitic profile of DM participant in the entire population surveyed in relation with their Income Status**

Income Status	NO. TESTED	NO. INFECTED	% INFECTED	OR	95 % CI	p-value
Low Income	169	36	21.4	1.1349	0.5866-1.9030	0.3047
Middle Income	91	22	24.2	0.8811	0.5255-1.7049	

Key: DM= Diabetes Mellitus, %= Percentage, OR= Odd ratio, 95% CI= 95% Confidence Interval



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Results on Risk Factors of intestinal parasites among DM participants in this study is presented in Table 4. It showed that Age was significantly statistically associated with the prevalence of intestinal parasitic infections in DM patients ( $p = 0.013$ ) with the age group 50-69 years having the highest prevalence of 31.3%. The level of education and occupation were very significantly associated with intestinal parasitic infections in DM patients ( $p = 0.009$ ;  $p = 0.031$ ; respectively). Females had intestinal parasites than males; gender was not a risk factor for acquiring intestinal parasites in DM patients (OR = 1.0159; 95% CI = 0.5665 – 1.7896;  $p = 0.148$ ). Class of DM is a risk factor for acquiring intestinal parasites in DM individual (OR = 0.8889; 95% CI = 0.1964-4.5960;  $p = 0.0195$ ) as showed in Table 4.





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**Table 4. Risk factor for intestinal parasitic infections among diabetic individual**

CHARACTERISTICS	NO. TESTED	NO. INFECTED	% INFECTED	OR	95% CI	p-value
<b>AGE</b>						
20 – 29yr	26	4	15.4			0.013
30 – 39yr	24	6	25.0			
40 – 49yr	64	15	23.4			
50 – 59yr	99	31	31.3			
60 – 69yr	46	6	13.0			
<b>SEX</b>						
Male	99	23	23.2	1.0159	0.5665 –1.7896	0.148
Female	161	38	23.6	0.9843	0.5588 - 1.7652	
<b>OCCUPATION</b>						
Unemployed	43	9	20.9			0.031
Civil servant	42	11	26.2			
Business	113	30	26.5			
Artisans	15	6	40.0			
Farmers	9	1	11.1			
Students	14	1	7.1			
Retiree	19	2	10.5			
Priest	4	1	25.0			
<b>EDUCATIONAL STATUS</b>						
None	55	16	29.1			0.009
Informal	19	3	15.8			
Primary	41	6	14.6			
Secondary	57	17	29.8			
Tertiary	84	16	19.0			
<b>ANNUAL INCOME</b>						
Low	169	36	21.4	1.1349	0.6029 –1.9328	0.3047
Middle high	91	22	24.2	0.8811	0.5174 –1.6586	
High	0	0	0.0			
<b>DM STATUS</b>						
Type 1	8	2	25.0	0.8889	0.1964 –4.5960	0.0195
Type 2	252	56	22.2	1.1250	0.2176 - 5.0911	

Key; DM= Diabetes Mellitus, %= Percentage, OR= Odd ratio, 95% CI= 95% Confidence Interval



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### DISCUSSION

In this study, 3.1% of the total surveyed population were having Type 1 DM while 96.9% were having Type 2 DM. Class of DM was found to be a risk factor for acquiring intestinal parasites in DM individual in this study at p-value of 0.0195. This might be because there are more Type II DM individual than Type I DM. The findings in this study agrees with the result obtained from WHO, (2016) who reported that distinct global estimates of diabetes prevalence for type 1 and type 2 does not exist. Tuomilehto (2013), reported that Type 1 diabetes is most common in Scandinavian populations in Sardinia and Kuwait, and much less common in Asia and Latin America and that Data are generally lacking for sub-Saharan Africa and large parts of Latin America. In the past few decades the annual incidence appears to be rising steadily by about 3% in high income countries (Dabelea, 2009). The high rate of participants (96.9%) having Type 2 DM (Figure 4.1) also agrees with the findings of WHO, (2010) stating that type 2 diabetes occurs increasingly frequently.

The intestinal parasitic profile (25%) obtained from Type I DM in this study was closely related to 27% reported by Zainab *et al.*, (2019). *Ascaris lumbricoides* infection was the most prevalent (23/62, 37.1%) while *Taenia spp* (2/62, 3.2%) has the lowest prevalence. This might be as a result of high burden of intestinal parasitic infections (IPIs) in developing countries. This finding was in line with previous studies which showed different parasites as the most prevalent parasites in their studies such as: *Giardia lamblia* (3.6%) in Cameroon (Tangi *et al.*, 2016), *Entamoeba histolytica* (6.7%) in Iran (Elnadi *et al.*, 2015), and *Cryptosporidium spp* (8.4%) in Ethiopia (Alemu *et al.*, 2018). This might be as a result of differences in geographical distribution of parasites across the globe. (Akinbo *et al.*, 2013).



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An overall prevalence of 21.9% of intestinal parasitic infections among DM individual recorded in this study might be due to the weak immune system of *Diabetes mellitus* patients (Al-mousawi *et al.*, 2021). The prevalence of intestinal parasitic infections among DM patients recorded in this study was higher than the 18.7% earlier reported by Akinbo *et al.* (2013), 10% prevalence reported by Tangi *et al.* (2016) in Cameroon, but lower than the 47% reported by Nazligul *et al.* (2001) and 44% prevalence reported by Waly *et al.* (2021) in Egypt. The prevalence of intestinal parasitic infections among DM patients recorded in this study was very close to that of Akinbo *et al.* (2013) and agrees with the suggestion that geographical location might be the reason for the higher prevalence recorded by Nazligul *et al.* (2001).

Unlike the 21% prevalence observed in the diabetic (case) group, the non-diabetic (control) group presented a lesser prevalence (3.3%) of intestinal parasites infection in this study. This might be attributed to the ability of their immune system to mount an effective defence mechanism against the invasion of the parasites. This is in agreement with Nada *et al.* (2015) who reported that intestinal parasites were found in 25 (25%) cases out of 100 patients in diabetic patients and 7(7%) cases out of 100 controls. Similarly, Akinbo *et al.* (2013) reported no parasites detected among non-DM individuals. Contrary to this, Waly, *et al.* (2021) reported a 32% prevalence of intestinal parasites among non DM individuals. This may be attributed to the way of life and personal hygiene of the people living in that area.

A total of 169 Diabetics with 36 (21.4%) of the low income and 91 diabetics with 22 (24.2%) of middle income were discovered in this research work. Income level or economic status seems not to be a risk factor of acquiring intestinal parasites in DM individual at p-value of 0.3047 as recorded in this study. Alemu *et al.* (2018) documented that Farmer and labour occupation, living in rural areas (Waley *et al.* 2021), type of toilet



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(Akinbo *et al.* 2013), poor educational background, poor hygiene and sanitation, and inappropriate latrine usage (Sintayehu *et al.* 2020) was significantly associated with intestinal parasitosis, all of which are factors common to people with low income status. This is in line with the high percentage (65%) of low income earners having intestinal parasitic infection prevalence of 21.4% reported during the study.

There are few data on the income gradient of diabetes in low- and middle-income countries, but data that exist suggest contrary submission to this study that the prevalence of diabetes was often highest among wealthy people, even though this trend is reversing in some middle-income countries hence the (24.2%) prevalence of intestinal parasites among middle income earners (WHO, 2010).

Age significantly affects the prevalence of intestinal parasitic infection in DM individual. Age group 50-59 years had the highest frequency of 31.3% at p value of 0.013. This might be as a result of weak immune system associated with ageing in Diabetes individual. This finding was consistent with the findings of Akinbo *et al.* (2013), Tangi *et al.* (2016), and Al-mousawi *et al.*, (2021). The reason for the finding in this study might be because all the DM participants were stable and asymptomatic (Akinbo *et al.* 2013),

The level of education and occupation were very significantly associated with intestinal parasitic infections in DM patients ( $p = 0.009$ ;  $p = 0.031$ ; respectively) with Secondary school educational status having highest frequency (29.8%) and Business class DM participants having highest frequency (26.5%) respectively. This is not in line with previous findings by Akinbo *et al.* (2013) may be because of the level of education of people and the type of business prevalence in this part of the country.

Females had intestinal parasites than males in this study. This might be due to the female high involvement in domestic activities such as taking care of children, animal, and house



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work, which may make them more exposed to parasitic infection than the male. In this study, gender did not affect the prevalence of intestinal parasitism among DM individual at p-value of 0.148, which was in line with the previous reports by Nazligul *et al.* (2001), Akinbo *et al.* (2013), and Al-mousawi *et al.* (2021).

### CONCLUSION

In this study, 25% of Type I DM and 22.2% of the Type II DM patients were infected with intestinal parasites.

An overall 21.9% prevalence of intestinal parasitic infection among DM patients was observed and 3.3% prevalence was observed among Non DM patients. This high prevalence of intestinal parasitic infection among DM patients may have been as a result of suppressed immunity nature of the DM patients and their inability to mount a strong immune defences against invasion by these intestinal parasites.

It was also observed that 21.4% and 24.2% of the low income and middle income participants respectively were infected with intestinal parasites. Economic status seems not to be a risk factor of acquiring intestinal parasitic infections in DM patients in this study.

Age, level of education and occupation were statistically significant factors in acquiring intestinal parasitic infections in this study, while Gender and Economic status seems not to be risk factors of acquiring intestinal parasitic infections in DM patients in this study. It is recommended that Patients with type 1 and type 2 DM should avoid occupation that predispose them to intestinal parasitic infection; Diabetes mellitus patients should be given immune boosters to help their system fight against intestinal parasitic infection, Screening routinely for intestinal parasites and frequently De-worm to chemo-prophylactically prevent and treat intestinal parasitism in both low and middle income earners is



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recommended; Awareness campaigns and educative programs should be organized to inform DM patients on how to prevent intestinal parasitism.

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