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Intestinal Parasitic Infections among Diabetes Mellitus Patients in Secondary Care Hospital in South Western Nigeria

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A B S T R A C T

Diabetes mellitus is a group of metabolic diseases in which a person has high blood glucose, either because the body does not produce enough insulin, or cells do not respond to the insulin produced. This study was conducted to determine the incidence of intestinal parasitic infections among diabetes mellitus patients which resulted into anaemia as well as the risk factors for acquisition of the parasitic infections. About 221 registered diabetes mellitus patients attending government clinics in Remo Health Zone were recruited for this study. Stool and blood specimens were obtained from each participant to detect intestinal parasites and to determine the blood level of the patients using standard techniques. Overall prevalence of 19.46% of intestinal parasitic infections among the study subjects was observed in this study, patients within the age group 51-60years had the highest prevalence of 39.53%. Toilet type significantly affected infection of intestinal parasites in the subjects ($p< 0.05$) with patients using pit latrines having the highest prevalence of 48.83%. The sanitary habits and personal hygiene conditions of the patients were risk factors of acquiring the parasite, patients who do not wash their hands had a prevalence rate of 20.8%. Anaemia was significantly associated with patients that had intestinal parasitic ($p<0.05$). More parasites are observed in type 2 (81.39%) than type 1 (18.6%) diabetes mellitus patients. *Ascaris lumbricoides* (51%), *Entamoeba histolytica* (35%), and Hookworm (14%) were the parasites recovered from diabetes mellitus patients. Packed cell volume of the subjects who had intestinal parasites which resulted into an anaemia was 29.65% and was statistically significant p-value <0.00. The prevalence of intestinal parasitic infection among the study subjects was high because the patients are immunocompromised which exposes them more to the infection therefore, routine diagnosis of intestinal parasitic infection of diabetes mellitus patients should be advocated. The risk factors that predispose them to acquiring these infections are; age, toilet type and eating habits, hence proper awareness and good information on personal hygiene and good environmental sanitation should be given to diabetic patient and the public.

Introduction

Diabetes mellitus is a group of metabolic diseases in which a person has high blood glucose, either because the body does not produce enough insulin or because cells do not respond to the insulin that is produced (Aune *et al.,* 2018). Although the most common infections in diabetes patients involve the skin and urinary tract, more severe infections may arise of blood sugars are not controlled. In most of the developing countries including Nigeria, the intestinal infections caused by parasite is one of the major health issues especially among immunocompromised individuals' parasitic infection are among the widespread of all chronic human infections worldwide (La Hoz *et al.,* 2019). They affect an estimated number of 3.5 billion of people and causes clinical morbidity in approximately 450 million people. Intestinal parasitic infections vary according to the endemicity in such location (Caner *et al.,* 2020).

It is known that diabetic patients are more susceptible to bacterial infections. Decreased arterial perfusion, neuropathy, and suppressed immune response in diabetes aggravate the frequency and severity of infectious diseases (Rabhi *et al.,* 2022).

The two main types of intestinal parasites are helminths and protozoan. Helminths are worms with many cells. Tapeworms, pin worms, and round worms are among the most common helminths. In their Adults form, helminthes, cannot multiply in the human body. Protozoa have only one cell, and can multiply inside the human body, which can allow serious infections to develop (Mahmud *et al.,* 2017).

Intestinal parasites are usually transmitted when someone comes in contact with infected faeces (for example, through contaminated soil, food, or water). Parasites can live within the intestines for years without causing any symptoms when they do, symptoms include, abdominal pain diarrhea, nausea, vomit gas, or bloating dysentery (loose stools containing blood and mucus which may lead to anaemia) (Delouche *et al.,* 2021).

World Health Organization (WHO, 2019) estimated that Schistosomiasis and soil transmitted helminthiasis represented more than 40% of the disease burden due to all tropical diseases excluding malaria (La Hoz *et al.,* 2019) studies have associated increased urogenital and intestinal parasitosis in "Type 2 diabetes". The aim of this study is to determine the incidence of intestinal parasitic infections among diabetes mellitus as well as the risk factors involved in the acquisition of these parasitic infection.

Materials and Methods

The study was carried out in the Secondary Health Care Center in Remo Health zone, southern, western region, of Nigeria. A total of 221 patients were recruited in the study, consisting (74 male and 147 female) registered, Diabetes mellitus patients attending clinic in the government hospital in Remo health zone. The age of the study participants ranged from 31 years to 90 years.

This are diabetes mellitus patients which came for routine visits depending on the appointment given by their clinicians. A questionnaire was designed and given to each participant to gather information about the various habit of each patient; this was used for the study. The Patient's hospital ID, laboratory number, age, gender was recorded. Stool samples were collected and examined for the presence of larva, cyst or ova of parasites.

Macroscopic Examination of the specimens were examined for consistency, colour, presence of mucus, blood, and to detect the presence of adult worms, or intestinal parasites were further identified using technique such as wet mount and iodine mount, other method of faecal examination are saturated sodium chloride formol ether concentration technique packed cell volume and fasting blood sugar.

The venous blood specimen was collected from the patient from the vein using a sterile needle and syringe and dispensed into an EDTA (Ethlyne Diamine Tetracetic Acid) or Flouride Oxalate anti-coagulant bottle and mixed. Data organization, analysis, and interpretation were done using appropriate statistical methods.

Results and Discussion

During the period of study, 221 registered diabetic patient attending diabetic clinic at General Hospitals in Remo Health Zone were investigated for intestinal parasitic infection. Table 1 shows the sociodemographic characteristics of the study participants. On the prevalence of intestinal parasite among diabetes mellitus patients, 43 (19.46%) had parasitic infection, and 178 (80.54%) were negative (Table 2).

Figure 1 shows the parasite distribution in the study from the stool of diabetes mellitus patient, *Ascaris lumbricoides* (51%), *Entamoeba histolytica* (35%), and Hook worm (14%), were the parasite recovered.

On the distribution of the prevalence of intestinal parasite according to gender, the female had the highest prevalence of 21.1% while male had the lowest with 16.2%. The difference in the gender was not statistically significant p=0.388 was not statistically significant (p=0.1666) (Table 3).

The age distribution of the occurrence of the parasite is shown in figure 2. The patient between the age group 51-60 years had the highest prevalence of (39.53%) while age group 31-40 years had the lowest of 2.33%. The difference in the age distribution was statistically significant (p= 0.0054).

Table 4 shows the relationship between type and duration of Diabetes Mellitus, patient with a duration of 1yr of diabetes mellitus had the prevalence of 26.8% and with type 1 diabetes mellitus (22.86%) while those with a duration of 2yrs had the lowest prevalence of (10.5%) while type 2 diabetes mellitus had a lower rate of (18.8%).

Table 5 shows the sanitary habits of the diabetes mellitus patient that were infected with intestinal parasite. Patients that used pit laterine had the highest prevalence of (48.83%) figure 3.

Table 6 shows the predisposing factor for acquiring intestinal parasite. Patient who don't wash their hand had a prevalence rate of 22% and patient who eat outside were infected with the parasite with a (20.86%). The level of education occupation and source of drinking water were not significantly associated with intestinal parasitic infection in diabetes mellitus patients (p=0.519, p=0.834, p=0.35 respectively).

Table 7 shows that intestinal parasite among diabetes patients is associated with anaemia and it is statistically significant with p value<0.05 with p value=0.005.

The study demonstrated the risk of intestinal parasitic infections among diabetes mellitus patients. In our study, the rate of intestinal parasites infection among DM patients was (19.46%) which is lower than 47% that was found and reported in a similar study by Nazligul *et al.,* (2001) and Almugadam *et al.,* (2021) in Antolia Turkey, intestinal parasites are very common because of the hot climate, agricultural usage of sewage, and inadequate purified drinking water and higher than (18.7%) reported by Akinbo *et al.,* (2013) in Owo, Ondo State and Maori *et al.,* (2021) in Kano State. The difference in this study and that of Nazgul is due to the use of sewage for agricultural purpose which is common in Anatolia which is discouraged in Nigeria where this study Akinbo *et al.,* (2013) and Maori *et al.,* (2021) in Kano State was done.

In a study by Rodríguez-Pérez *et al.,* (2019) the frequency of opportunistic intestinal parasite in immunocompromised hosts was found in 8% of diabetes patients this differs from the result of this study which is 19.46% of the diabetes mellitus patients.

Ascaris lumbricoides, Entamoeba histolytica, and Hookworm are the three parasites found, which agrees with a previous study by Rodrigues *et al.,* (2019). These infections are most prevalent in tropical and subtropical regions of the developing world where adequate water and sanitation facilities are lacking (AlDallal *et al.,* 2018). Hookworm infection causes anaemia and protein deficiency induced by blood loss at the site of attachment by the adult worm. Recent estimates suggest that *A. lumbricoides* can infect over a billion, and hookworms 740 million people. Intestinal helminths rarely cause death, instead, the burden of disease is related to less mortality than to the chronic and insidious effects on health and nutritional status of the host (Hussein & Neamah, 2021). Amoebiasis caused by *Entamoeba histolytica* is the third leading cause of death from parasitic diseases worldwide, with its greatest impact on the people of developing countries. The World Health Organization (WHO) estimates that approximately 50 million people worldwide suffer from invasive amoebic infection each year, resulting in 40-100 thousand deaths annually (La Hoz *et al.,* 2019).

Entamoeba histolytica can cause intestinal ulcerations, bloody diarrhoea, weight loss, fever, gastrointestinal obstruction, and peritonitis. Amoeba can cause abscess in the liver that may rupture into the pleural space, peritoneum, or pericardium (Sisu *et al.,* 2021). The finding that gender did not affect the prevalence of intestinal parasitic infections among diabetes mellitus patients with the age group 51-60years having the highest prevalence of intestinal parasitic because of poor glycemic control in Type 2, because high glucose level limit and deregulate neutrophils synthesis which is essential in the immune system to attack a foreign object.

Table.1 Sociodemographic characteristics of the study participants.

Characteristics		No tested	No infected	%	X^2	P value
Gender	Male	94	12	16.2	0.75	0.368
	Female	147	31	21.1		
Level of Education	No formal	52	13	25	2.27	0.519
	Primary	58	11	19		
	Secondary	71	14	19.7		
	Tertiary	5	5	12.5		
Age	31-40	4	1	25	1.18	0.0054
	41-50	4 5	9	15.6		
	51-60	84	17	20.2		
	61-70	54	11	20.4		
	71-80	32	7	21.9		
	81-90	2	0	0		
Washing of Hand	Yes	60	7	11.67	1.06	0.304
	No	161	36	22.36		
Eating of raw food	Yes	110	22	20	0.04	0.839
	No	111	21	18.9		
Source of drinking water	Borehole	194	38	19.6	0.33	0.840
	Well	14	2	14.3		
	River	13	3	23.1		

Table.2 Prevalence of Intestinal Parasite among Diabetes Mellitus Patients

Diabetes Mellitus Patient	Number	Prevalence%
Infected with parasite	43	19.46
Not infected with parasite	178	80.54
Total	221	

Table.3 Distribution of Intestinal Parasites by Gender

Gender	No tested	No infected	%	P value
Male	94	12	16.3	0.368
Female	147	31	21.1	

Table.4 Relationship between type and duration of diabetes mellitus and intestinal parasitic infections

Characteristics		No tested	No infected (%)	X^2	P value
Type of Diabetes mellitus					
	Type 1	35	8 (22.86)	0.31	0.642
	Type 2	186	35 (18.8)		
Duration of Diabetes mellitus					
	1 yr	41	11 (26.8)	0.31	0.642
	2 yrs	38	4 (10.5)		
	3 yrs	142	28 (19.7)		

Table.5 Distribution by Sanitary Habits

Type of toilet	No infected	%	X^2	P value
Water closet	19	44.19	3.09	0.0021
Pit laterine	21	48.84		
Bush	34	6.97		
Total	**43**			

Table.6 Predisposing Factors for Acquiring Intestinal Parasites by DM Patients

Characteristics	No tested	No infected	%	X^2	P value
Eating habit				0.03	0-0056
Outside	125	26	20.8		
Home	96	17	17.7		
Boiling of water				1.28	0.641
Yes	56	8	14.3		
No	165	35	21.2		
Occupation				2.11	0.834
Civil servant	53	11	20.87		
Trader	108	20	18.5		
Farmer	10	1	10		
Artisan	19	3	15.8		
Housewife	9	3	33.3		
Pensioner	22	5	22.7		

Table.7 Packed Cell Volume (PCV) Results of DM Patients

Patients	Number	Mean (PCV value)	± SEM	P value
With parasite	43	29.65	±0.70	0.005
Without parasite	178	35.51	±0.44	+0.44

Figure.1 Frequency of Parasite in Diabetes mellitus patients

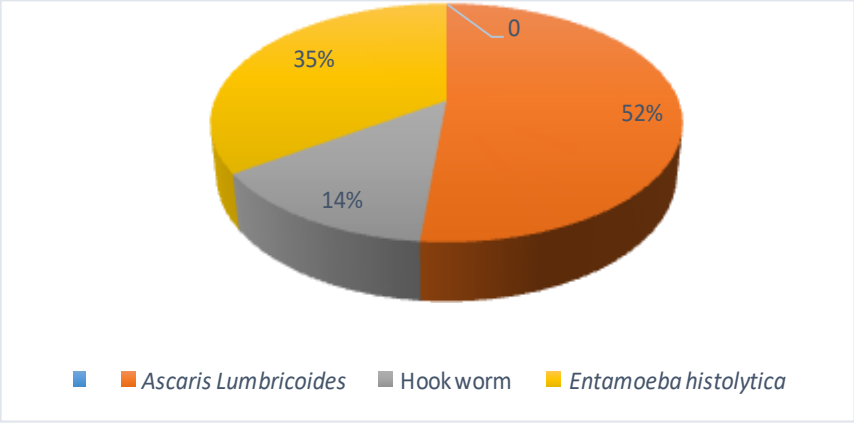


Figure.2 Prevalence of intestinal parasitic infection in diabetes mellitus patient according to age

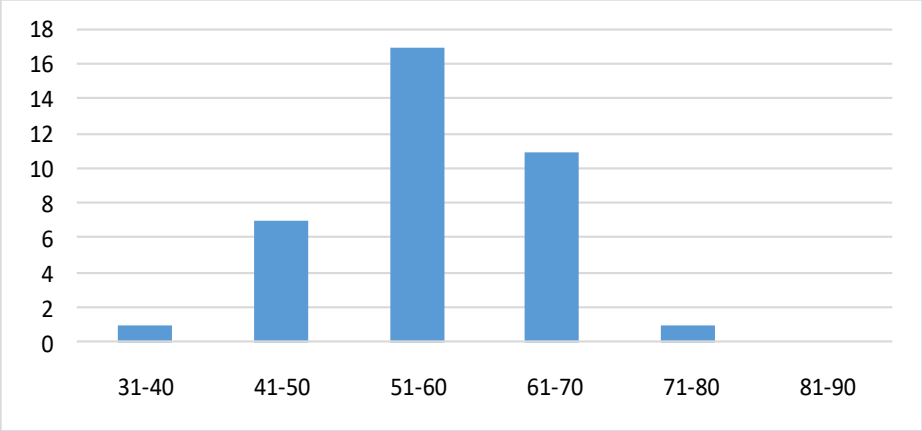
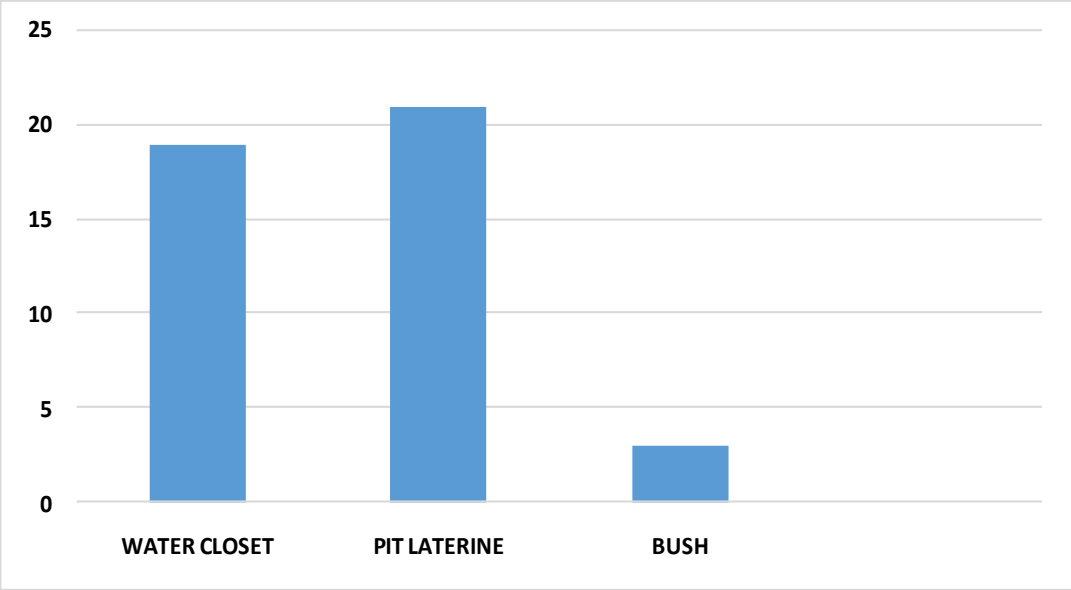


Figure.3 Sanitary Habits of DM Patient Having Intestinal Parasite



Infectious disease are more prevalent in individual with diabetes mellitus. The main pathogenic mechanism are hyperglycemic. Preventing the development of diabetic complications such as infections, kidney failure, and amputation involves proper glycemic control (Sharma *et al.,* 2018).

This study revealed the incidence of intestinal parasite among diabetes mellitus patients and established the age of 50-61 years as the age with the highest parasite load and also sanitary habit (those that use pit latrine) of Diabetes mellitus patients that prone to intestinal parasitic infection. It has shown the risk factors (sanitary conditions and eating habits) that predispose diabetes mellitus patients to acquisition of this parasitic infection therefore establishing the need for routine diagnosis of intestinal parasite among diabetes mellitus patients especially among type 2 diabetes mellitus patients.

It was concluded that with an overall prevalence of 19.46% of intestinal parasitic infection observed among diabetes mellitus patients and this resulting to anemia, this present study has shown the importance of routine investigation and diagnosis of intestinal parasites in diabetic patient; and emphasize the need for among clinicians regarding the occurrence of these parasite in this population and subsequent health education of the population for food hygiene. The frequency and the

danger of those opportunistic infections require their efficient diagnosis and appropriate management. The age, type of toilet and eating habit of diabetes mellitus significantly affects the prevalence of the infection, hence, proper education and good information on personal hygiene and good environmental sanitation should be given to diabetic patient and the public.

Ethical Approval and Consent to Participate

The approval for this study was given by the ethical committee of Remo Health Zone (Ref. No – RHZ/Vol 001/12/105). Informed consent was obtained from each participant prior to specimen collection.

Consent for Publication

Not applicable

Availability of Data and Materials

The authors declare consent for all available data present in this study.

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Authors' Contributions

Conception and design the work/idea, Collect data/obtaining results: Ibukun Akinsola OMISAKIN, Manuscript writing: Kenneth Oshiokhayamhe IYEVHOBU, Analysis and interpretation of data: Olawale Sunday ANIMASAUN, Critical revision of the manuscript: Rex IKEDE, Favour Eromosele OTOIKHINE, Statistical advice: Jeremiah Oluyemi AROWOLO, Ebere EKPENISI-IGUMBOR, Final research review: Victoria Osahon OMOKPO, Anthony Junior ADEJI.

Competing Interests

The authors declare no conflicts of interest

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