Hindawi
Advanced Gut & Microbiome Research
Volume 2022, Article ID 4829943, 5 pages
https://doi.org/10.1155/2022/4829943

Research Article

Intestinal Parasitic Infections among Diabetic Patients in Tertiary Care Hospital

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Received 30 September 2022; Revised 31 October 2022; Accepted 1 November 2022; Published 15 December 2022

Academic Editor: Qixiao Zhai

Background and Aims. This study was conducted to investigate intestinal parasitic infections among diabetes patients compared to nondiabetic (control) individuals and examine the intensity of parasitosis in both groups. Even though diabetes poses a risk for parasitic infections, similarly, few recent studies suggest that parasitic infections, especially toxoplasmosis, and cysticercosis affecting pancreatic cells, can cause a decrease in insulin secretion, thus leading to diabetes. A retrospective study was carried out to find intestinal parasite infections among diabetics and nondiabetics in tertiary care hospitals. The records were collected from Microbiology Laboratory for five years. Out of 625 patients included in the study, two hundred twenty-seven (36.7%) were diabetic. Of these, most of the intestinal infections were caused by Hookworm (26.58%), followed by *Blastocystis hominis* (23.2%), and Entamoeba histolytica (12.23%). The risk factors involved in increased intestinal parasitosis were HIV and anemia. The most common parasite isolated among HIV patients was Isospora belli (30.23%). In anemic patients, Hookworm (4.04%) was the most frequently isolated parasite. This study also highlights the risk factors for acquiring intestinal parasites in diabetic patients, especially among patients with other comorbidities such as HIV.

1. Introduction

In most of the developing countries including India, the intestinal infections caused by parasites is one of the major health issues especially among immunocompromised individuals. Globally high prevalence of parasitic infections is observed in low socio-economic strata mostly the regions of tropic and the subtropic [1]. Amoebiasis, Giardiasis, Ascariasis, Trichuriasis, and Hookworm infections are the most common infections seen in India [2]. Intestinal parasites are on the rise as most are opportunistic pathogens responsible for clinically significant infections occur in immunosuppressed patients. These infections are mainly present in diabetes and HIV Positive patients [3, 4]. Intestinal parasitosis impairs the body's metabolism, nutrition absorption, and gut ecosystem. Diabetes mellitus (DM) is a metabolic noncommunicable disease 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 [6]. Globally, it is estimated that almost 382 million people suffered from diabetes (8.3%). The prevalence of the diabetic patients infected with intestinal parasites in our country is almost undetected and the efficacy of the treatment or preventive methods remains uncertain. Diabetes mellitus can lead to opportunistic intestinal parasitic infections [5]. Parasitic pathogens are the major source of diarrheal disease in developing countries, e.g., *Entamoeba histolytica*, *Giardia lamblia*, and *Strongyloides stercoralis* or an opportunistic pathogen, *Cryptosporidium, Isospora, Cyclospora and Microsporidia* [4]. Of all the parasitic infections, Amoebiasis is the third most common infection leading to death [7]. Soil-transmitted helminths (STH) infections form the most important group of intestinal worms affecting two billion people worldwide [8, 9]. There are recent studies which have associated increased urogenital and intestinal parasitosis in Type-2 diabetics as compared with nondiabetic group [14]. The aim of our study is planned to investigate the intestinal parasitic infections among diabetes patients compare to nondiabetic (control) individuals and examine the intensity of parasitosis in both groups.

2. Materials and Methods

General information: a retrospective study was carried out in the tertiary care center in south India. Institutional ethical committee approval was obtained (Reference number – IEC 149/2017). Data analysis was carried in 625 patients with intestinal parasitic infections with and without diabetes who visited a Tertiary Care Hospital for last 5 years. Information regarding the positive cases detected during the study period was collected from the hospital records, using the hospital information system database of the institution. Helminthic parasites eggs and larvae were identified using microscopic techniques such as wet mount and iodine mount. For protozoan parasites, staining methods such as Modified ZN, Trichrome, and giemsa stains were used for cysts and trophozoites identification. Serological methods for antigen detection from stool samples were also used for *Cryptosporidium, Giardia lamblia*, and *Entamoeba histolytica*. The patient's hospital ID number, age, gender, HIV status, WBC count, and eosinophil count were also recorded. Data organization, analysis, and interpretation were done using appropriate statistical methods.

3. Results

Out of 227 diabetic patients, most common parasites were found to be *Hookworm* (26.58%) followed by *Blastocystis hominis* (23.2%) and *Entamoeba histolytica* (12.23%), whereas similar number of parasites were seen in control nondiabetics group ($P > 0.05$). However, diabetic patients with comorbidities such as HIV and anaemia as compared to the control group, the odds of testing positive for intestinal parasitic diseases (AOR: 2.012, 95% CI: $P = 0.057$) were greater than nondiabetic individuals. Likewise, the intensities of opportunistic infections such as coccidian parasites were much higher in the diabetic patients and positively correlated with the duration of illness. Intestinal parasitic coinfection was observed in equal number of diabetic nondiabetic patients. Among diabetics, the predominant association observed was seen between *Blastocystis hominis* and *Trichomonas* spp. (30%). However, among nondiabetics, varied associations were seen, e.g., Hookworm-*Trichomonas* spp., *Blastocystis hominis-Trichomonas* spp., *Cryptosporidium parvum-Entamoeba histolytica*, etc.

Here are the results of gender distribution of diabetics and nondiabetic patients. Out of the two hundred and twenty-seven diabetic patients, 158(69.9%) were male while 69(30.4%) were female. Among three hundred and ninety-eight nondiabetic patients, 279 (70.1%) were male while 119(29.9%) were female as shown in Table 1.

Age distribution with intestinal parasitic infections among diabetics and nondiabetics is shown in Table 2. 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. Of the total patients ($n = 625$), the three most common parasites in the age group of 0-20 years were found to be *Giardia lamblia*, *Blastocystis hominis* (1.7%), and *Entamoeba histolytica* (1.54%), respectively, and in between 21-40 years, Hookworm (9.44%), *Blastocystis hominis* (6.5%), and *Entamoeba histolytica* (5.26%) were seen, while in between 41-60 years of age, Hookworm (10.37%), *Blastocystis hominis* (4.95%), and *Entamoeba histolytica* (3.56%)were common and above >60 years. Hookworm (5.88%), *Blastocystis hominis* (5.26%), *and Entamoeba histolytica* (1.39%) were commonly found.

Table 1: Gender distribution of intestinal parasitic infections in diabetic and nondiabetic patients.

Gender	Diabetic (no.) %patients		Nondiabetic (no.) %individuals	
Male	158	69.9	279	70.1
Female	69	30.4	119	29.9
Total	227	44.32%	398	63.68%

(i) Hookworm was observed in 26.58%, *Blastocystis hominis* in 23.2%, *Entamoeba histolytica* in 12.23%, *Strongyloidiasis stercoralis* in 5.9%, *Giardia lamblia* in 5.06%, *Enterobius vermicularis*, and *Entamoeba coli* in 4.21%, respectively (Figure 1)

(ii) Out of two hundred twenty-seven (36.32%) diabetics, 11 (1.76%) were infected with HIV. Among these patients, the most commonly observed parasites were coccidian parasites such as *Isospora belli* (30.23%), *Cryptosporidium* spp. (27.9%), *Cryptosporidium* spp. (27.9%), *and Cyclospora cayetanensis* (13.95%)

(iii) Among anemic patients with diabetes, *Hookworm* (4.04%), *Enterobius vermicularis* (2.02%), *Isospora belli* (2.02%), *Trichomonas* spp.(2.02%), *Strongyloides stercoralis* (2.02%), *Giardia lamblia* (1%), *Blastocystis hominis* (1%), and *Cryptosporidium parvum* (1%) were the commonly observed intestinal parasites

4. Discussion

The present study demonstrated the risk of intestinal parasitic infections in diabetics and other immunocompromised status patients. Emerging intestinal parasites have gained increasing recognition as important opportunistic pathogens; implicated in clinically important infections in these immunosuppressed patients. In our study, 36.6% patients with diabetes had intestinal parasitosis which is lower as compared to study done by Nazilgul et al. [12] but much higher as compared with study from sub-Himalayan region of Northern India [13], the higher prevalence in our study might be due to inclusion of all the parasites but only few parasites were included in above study [13]. Among the diabetic patients, intestinal parasitic infections were mostly seen between the age group of 41-60 years with no statistical difference as compared in the similar age group of

Table 2: Distribution of intestinal parasites among diabetic patients of different age groups.

Intestinal parasites isolated	AGE RANGE (in years) 0-20 years	21-40 years	41-60 years	ABOVE 60 years
Entamoeba coli	0.3%	1.08%	0.92%	1.23%
Entamoeba spp.	0.3%	0.61%	0.15%	—
Entamoeba histolytica	1.54%	5.26%	3.56%	1.39%
Giardia lamblia	1.7%	4.02%	2.47%	0.46%
Blastocystis hominis	1.7%	6.5%	4.95%	5.26%
Hook worm	1.08%	9.44%	10.37%	5.88%
Enterobius vermicularis	0.46%	0.61%	1.39%	1.08%
Trichuris trichiura	0.3%	0.15%	0.15%	0.3%
Hymenolepis nana	0.15%	—	0.15%	0.15%
Taenia spp.	—	0.15%	—	—
Endolimax nana	—	0.15%	—	—
Iodamoeba butschlii	—	—	0.3%	—
Isospora belli	0.3%	2.63%	2.63%	—
Echinostoma spp.	—	0.15%	—	—
Trichomonas spp.	0.46%	2.32%	0.92%	0.61%
Trichomonas vaginalis	—	—	—	0.15%
Trichomonas hominis	—	0.15%	—	—
Chilomastix meslini	—	0.15%	—	0.46%
Cyclospora spp.	0.15%	—	0.46%	—
Cyclospora cayetanensis	—	0.92%	0.61%	0.61%
Strongyloides stercoralis	0.15%	0.77%	2.47%	1.23%
Cryptosporidium spp.	0.15%	0.15%	0.46%	—
Cryptosporidium parvum	0.15%	0.92%	1.7%	—
Microsporidia	—	0.15%	—	0.15%
Ascaris lumbricoides	—	1.08%	0.46%	0.3%
TOTAL	8.97%	37.46%	34.21%	19.34%

nondiabetics. Tangi et al. in 2016 reported a higher incidence of parasitic infections in the middle age (13.3%) [6]. Akinbo et al. reported a female preponderance of 78.57% which differed from our study i.e. male preponderance of 69.9% was seen [10]. The inconstancy of gender difference may be due to sex dependent distribution of the disease which mainly depends on socioeconomic and environmental factors. The most common parasitic infection that was observed in the diabetic and nondiabetic group was Hookworm infections followed by *Blastocystis hominis* 23.2% and 15.64%, respectively. The higher prevalence of Hookworms was due to majority of the local population engaged in agriculture, and many of the Hookworms larvae were found in these agricultural fields and many farmers usually works barefoot in these areas which leads to larval penetration of the skin thus leading to Hookworm infections.

Twenty-five different species of intestinal parasites were observed in our study of which eight were helminths and seventeen were protozoan parasites. This differs from Tangi et al. study where out of 235, majority of parasites isolated were *Entamoeba histolytica*, *Blastocystis hominis*, *Cryptosporidium parvum* and *Ascaris*, and Hookworms were isolated [6]. It also differs from another study carried out in Turkey where again only five parasites were isolated—all being protozoans [11]. Higher proportion of parasites may be attributed to the large sample size, high salinity, rural demographics, and the readily available health care services.

In a study conducted in Ethiopia, *Blastocystis hominis* was the most frequent protozoan followed by *Cryptosporidium parvum* and *Giardia lamblia* in HIV positive patients. Among our two hundred twenty-seven diabetic patients, 1.76% were HIV positive; among whom the most common parasite was found to be *Isospora belli* followed by *Cryptosporidium* spp.., *Cyclospora cayetanensis* and *Blastocystis hominis*. In another study in Iran, the most common parasite observed in HIV positive patients was *Blastocystis hominis* (7%) compared to 2.32% in our study. *Blastocystis hominis* is a potential opportunistic pathogen in immunosuppressed hosts; impaired intestinal mucosal integrity in diabetes explains the increased risk [10]. The differences encountered when compared to literature may be due to different socio-demographic and geographic factors.

Diabetes as a disease is known to cause anaemia due to reduced erythropoietin production owing to the concomitant kidney disease [10]. This study highlights that intestinal parasitic infection among diabetic patients can also result in clinically significant anaemia with *Hookworm* having the highest frequency, followed by *Enterobius vermicularis* etc.

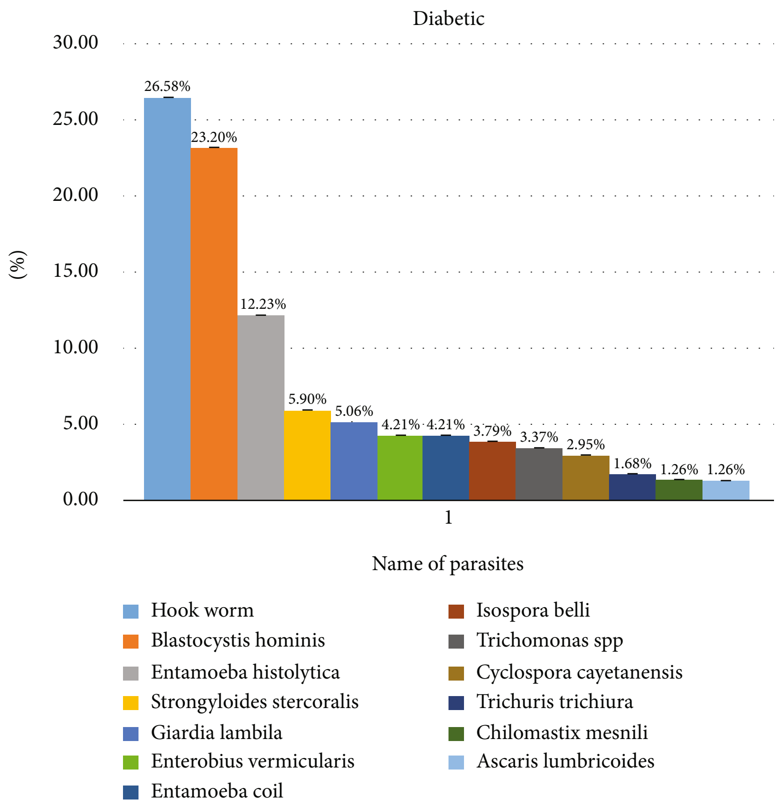

Figure 1: Distribution of intestinal parasites among diabetics.

However, the specific type and duration of diabetic state or glycaemic control did not affect the occurrence of intestinal parasitosis. Nazigul et al. reported a prevalence of 55.9% among nondiabetic patients, which in their study was significantly higher as compared to the diabetic group [12]. This is in concordance with our study with 63.7% patients in the nondiabetic group with intestinal parasitosis; with a similar spectrum of the isolated species as in the diabetic group [12]. This can be attributed to larger sample size, increased prevalence of these parasites in our region and in part by the greater number of hospital visits by diabetic patients who are possibly treated for parasitic infestations. Although, Olusegun et al. [10] and Cheesbrough [13] reported no intestinal parasites in the nondiabetic group owing to low prevalence of intestinal parasites in that region. Organisms such as *Cryptosporidium*, *Trichomonas hominis* and *Taenia* spp. were not isolated form diabetic patients. The probable explanation for this disparity may be attributed to selection criteria of cases and potential confounders like other concomitant immunosuppressed states in the non-diabetic control group which were not analysed in the present study.

Recent studies indicated increase association of T2DM with not only intestinal parasitic infections but also urogenital infections [14]. Our study has not taken parasitic infection from other organs and in future we would like to know the association of DM and parasitic infections causing systemic infection other than intestines. Multiparasitism existed predominantly among *Blastocystis hominis*, *Trichomonas* spp., *Hookworm*, and *Enterobius vermicularis* in both diabetic patients and nondiabetic patients. The most common association was between *Blastocystis hominis* and *Trichomonas* spp. in the diabetic group while the nondiabetic group showed various combinations of multiparasitism which was similar when compared to Tangi et al. [6] study in which multiparasitism existed only among protozoan species such as *Entamoeba histolytica* and *Entamoeba coli*. This can be explained by the large sample size and higher parasitic yield of our study.

5. Conclusion

It was concluded that the prevalence of parasitic infections was more significant among nondiabetic patients in comparison to diabetic patients. The occurrence of intestinal parasitic infections in diabetic patients is 36.32%; the most common types were being of Hookworm (26.58%), *Blastocystis hominis* (23.20%), and *Entamoeba histolytica* (12.23%). Hence, this study highlights the various demographic and clinical risk factors towards acquisition of intestinal parasites both in diabetics and nondiabetic control group.

Data Availability

Data relevant to the study are available and included in the manuscript.

Ethical Approval

Ethical approval was taken from Hospital Ethical Institutional Committee (Reference number–IEC 149/2017).

Conflicts of Interest

The authors wish to state that there is no conflict of interest in the work presented in this article. None of the authors of this paper have any financial or personal relationship with other people that could inappropriately influence or bias the content of the paper.

Authors' Contributions

VK were responsible for the study concept and design and manuscript drafting. LK and RK were responsible for data acquisition, data interpretation, and statistical analysis. SV and VA were responsible for supervision and manuscript critical revision. The manuscript has been checked and approved by all the authors.

References

[1] N. R. De Silva, S. Brooker, P. J. Hotez, A. Montresor, D. Engels, and L. Savioli, "Soil-transmitted helminth infections: updating the global picture," *Trends in Parasitology*, vol. 19, no. 12, pp. 547–551, 2003.

[2] N. Shrihari, T. S. Kumudini, J. Mariraj, and S. Krishna, "The prevalence of intestinal parasitic infections in a tertiary care hospital – a retrospective study," *Journal of Pharmaceutical and Biomedical Research*, vol. 12, pp. 1–3, 2011.

[3] J. Dhanabal, P. P. Selvasoss, and K. Muthuswamy, "Comparative study of the prevalence of intestinal parasites in low socioeconomic areas from South Chennai, India," *Journal of Parasitology Research.*, vol. 2014, article 630968, pp. 1–7, 2014.

[4] R. R. Prabhakar, "Study of opportunistic intestinal parasitic infections in HIV seropositive patients at a tertiary care teaching hospital in Karnataka, India," *International Journal of Contemporary Medical Research*, vol. 3, no. 8, pp. 2219–2222, 2016.

[5] A. F. Bafghi, M. Afkhami-Ardekani, and A. D. Tafti, "Frequency distribution of intestinal parasitic infections in diabetic patients – Yazd," *Iranian Journal of Diabetes and Obesity*, vol. 7, pp. 33–37, 2015.

[6] F. B. Tangi, E. B. Fokam, N. A. Longdoh, and E. J. Eteneneng, "Intestinal parasites in diabetes mellitus patients in the Limbe and Buea Municipalities, Cameroon," *Diabetes Research - Open Journal*, vol. 2, no. 1, pp. 1–7, 2016.

[7] M. Mohtashamipour, S. H. Ghaffari Hoseini, N. Pestehchian, H. Yousefi, E. Fallah, and T. Hazratian, "Intestinal parasitic infections in patients with diabetes mellitus: a case-control study," *Journal of Analytical Research in Clinical Medicine*, vol. 3, no. 3, pp. 157–163, 2015.

[8] R. Haque, "Human intestinal parasites," *Journal of Health, Population, and Nutrition*, vol. 25, no. 4, pp. 387–391, 2007.

[9] WHO, "Soil transmitted Helminth infections," Accessed 21.07.13, https://www.WHO.int/mediacentre/factsheets/fs366/en/.

[10] F. Akimbo, O. Olujobi, R. Omoregie, and C. Egbe, "Intestinal parasitic infections among diabetes mellitus patients," *Biomakers and Genomic Medicine*, vol. 5, no. 1-2, pp. 44–47, 2013.

[11] M. Dudeja, S. Nandy, A. K. Das, S. Alam, and R. Tiwari, "Prevalence ofIntestinal parasites in slum areas of southern Delhi," *International Journal of Microbiology Research*, vol. 4, pp. 312–315, 2012.

[12] Y. Nazligul, T. Sabuncu, and H. Ozbilge, "Is there a predisposition to intestinal parasitosis in diabetic patients?," *Diabetes Care*, vol. 24, no. 8, pp. 1503-1504, 2001.

[13] V. Moudgil, R. Rana, P. K. Tripathi, U. Farooq, R. Sehgal, and M. A. Khan, "Coprevalence of parasitic infections and diabetes in sub-Himalayan region of northern India," *International Journal of Health Sciences*, vol. 13, no. 1, pp. 19–24, 2019.

[14] B. S. Almugadam, M. K. Ibrahim, Y. Liu et al., "Association of urogenital and intestinal parasitic infections with type 2 diabetes individuals: a comparative study," *BMC Infectious Diseases*, vol. 21, no. 1, p. 20, 2021.