

CLINICOMYCOLOGICAL STUDIES IN DIABETIC PATIENTS.

Dr Abrar Hussain¹, Dr Parimal Patel^{2*}

¹Medical Officer, PHC Kharod, Ankleshwar, Bharuch, Gujarat, India

^{2*}Associate Professor, Department of Microbiology, GMERS Medical College, Valsad, Gujarat

*Corresponding Author: Dr Parimal Patel

*Associate Professor, Department of Microbiology, GMERS Medical College, Valsad, Gujarat

ABSTRACT:

Introduction- Diabetes is a chronic, metabolic disease characterized by elevated levels of blood glucose, which leads to serious damage to various organs of the body over time being. It has already been predicted that diabetes in India would be seen in around 79.4 million individuals by 2030. It has been found that various conditions associated with diabetes mellitus like high blood glucose, neuropathy, immunological disturbances and vascular insufficiency enable the colonization of various pathogenic fungi. The aim of the present study is to assess the susceptibility of diabetics to various types of fungal infections.

Objective- To study the prevalence of fungal infections in diabetics and assess the susceptibility of the diabetics to various fungal infection.

Methodology- Total 60 samples were collected along with the clinical and demographic profile of the patient from which 20 were from patients suffering from Type 1 Diabetes Mellitus and 40 were from the patients suffering from Type 2 Diabetes Mellitus. The samples were subjected to direct microscopy using KOH and culture was done using 2 slants of Sabouraud's dextrose agar. The isolates were identified by pigment production, colony morphology and examination of the smear from colony was done by cellophane tape mount and tease mount.

Results- Out of the 60 samples, 26(43.33%) were positive for fungal growth. The most common organism isolated was *Candida albicans* while other organisms like *Candida tropicalis*, *Candida krusei*, *Candida parpsilosis*, and *Trichophyton* spp. were observed. The most affected age group was of 41-60 years. Out of the total positive samples, 69%(n=18) were collected from the rural/tribal population. The majority of the positive samples i.e. 20 (76%) were collected from the patient who never got their blood levels checked for follow up. Also in all of the patients, fungal infection was not suspected as cause of infection initially by the treating physician leading to prescription of antibiotics instead of antifungals.

Conclusion- The present study shows a considerable prevalence of fungal infections among the diabetic patients thus making it a serious health problem in this area. There is an urgent need of strategies regarding public health education to make the patients aware about the condition leading to early diagnosis. Also healthcare providers at all the levels should also be made aware of these findings so that they can keep fungal infection in their mind as a differential for infections in diabetics.

Keywords- Diabetes, Fungal infection,

INTRODUCTION

Diabetes is a chronic, metabolic disease characterized by elevated levels of blood glucose (or blood sugar), which leads to serious damage to the heart, kidneys, eyes, blood vessels and nerves over time being. ^[1] Diabetes can be considered as a potential epidemic in India as a study concluded that the

incidence of diabetes would be double globally by the year 2030. [2] It has also been predicted that diabetes in India would be seen in around 79.4 million individuals by 2030. [2,3]

Diabetes Mellitus has an immunosuppressive effect on the individual which is attributed by the fact that there is a compromise of cellular immunity and also there occurs changes in monocytes, lymphocytes and various polymorphonuclear cells. [4] which makes the individual more susceptible to fungal infections which leads to an increased incidence of morbidity and mortality in hospitalized patients. [5,6] A study concluded that various conditions associated with Diabetes Mellitus like high blood glucose, neuropathy, immunological disturbances and vascular insufficiency enable the colonization of the pathogenic fungi like *Candida*, *Aspergillus*, *Dermatophytes*, *Fusarium*, *Malassezia* and *Zygomycetes*. [7,8,9]

The increased incidence of infections like mucocutaneous candidiasis and invasive zygomycosis found in diabetic patients is attributed to the fact that due to high glucose level extra sugars may be secreted in urine, sweat and mucous. So they are the major causes of colonization of pathogenic fungi in diabetics. [10,11]

India being a tropical country, there is a very high prevalence of fungal infections. [12].

However, due to availability of very few conclusive studies and the superadded factor of lack of evidence to support this predisposition, [13] there is a serious need to assess the susceptibility of diabetic patients towards fungal infection and association of fungal infection with diabetes.

AIMS AND OBJECTIVES

- To assess the susceptibility of diabetics to various types of fungal infection
- To study the prevalence of fungal infections in diabetics.

MATERIALS AND METHODS

A cross sectional study was carried out in the Microbiology laboratory at Tertiary Care Hospital in South Gujarat. All the specimens were collected from the patients visiting the OPD and IPD of the hospital after taking oral and written consent of the patient. Specimens (according to the site of lesion) were collected from the patients who were known case of Diabetes Mellitus.

SPECIMEN COLLECTED (According to the site of lesion):-

- Skin scrapping – For superficial mycotic infection
- Urine – For urinary tract infection
- Swab from wounds – For wound infection
- Sputum – For respiratory tract infection

SAMPLE SIZE: 60 patients

SELECTION CRITERIA:-

Inclusion criteria:

- The patient must be a diabetic.
- The patient must be a clinically suspected case of an infection.

Exclusion criteria:

- Pregnant women
- Patients on antifungal therapy.

MATERIALS:

1. Piece of dry, sterile paper.
2. Sterile universal container.
3. Sterile swab.

4. Sterile container.
5. Uncontaminated specimen.
6. 10% and 40% KOH.
7. Gram Staining Kit comprising of Crystal violet, Gram's iodine, Acetone and Safranin
8. Culture Media: Sabouraud's dextrose agar.
9. Incubator.

METHODS:

The specimens were collected after taking oral and written consent.

- The skin scrapping was collected in piece of dry, sterile paper.
- The urine sample and the sputum sample were collected in sterile universal container.
- The swab from the infected wound was collected by scrubbing the sterile swabs from the wound's depth.

SAMPLE PROCESSING: Total 60 samples were collected along with the clinical and demographic profile of the patient from which 20 were from patients suffering from Type 1 Diabetes Mellitus and 40 were from the patients suffering from Type 2 Diabetes Mellitus. The samples were subjected to direct microscopy using KOH and culture was done using 2 slants of Sabouraud's dextrose agar. The isolates were identified by pigment production, colony morphology and examination of the smear from colony was done by cellophane tape mount and tease mount.

OBSERVATIONS AND RESULTS

During the period of study total 60 samples were collected out of which 48(80%) were from male patients and 12(20%) were from female patients.

Out of the 60 samples, 20(33.33%) were collected from the patients who were suffering from Type 1 Diabetes Mellitus which is Insulin Dependent Diabetes Mellitus and 40(66.67%) were collected from the patients who were suffering from Type 2 Diabetes Mellitus which is Non Insulin Dependent Diabetes Mellitus.

26(43.33%) out of the 60 samples were positive for fungal growth while 34(56.37%) were negative for fungal growth as shown in figure 1. Out of the total 26 positive samples, 19(73.07%) were isolated from male patients while 7(26.92%) were isolated from female patients which is shown in table 1. The highly affected age group was of 41-60 years as 13(50%) out of 26 positive samples belonged to this age group.

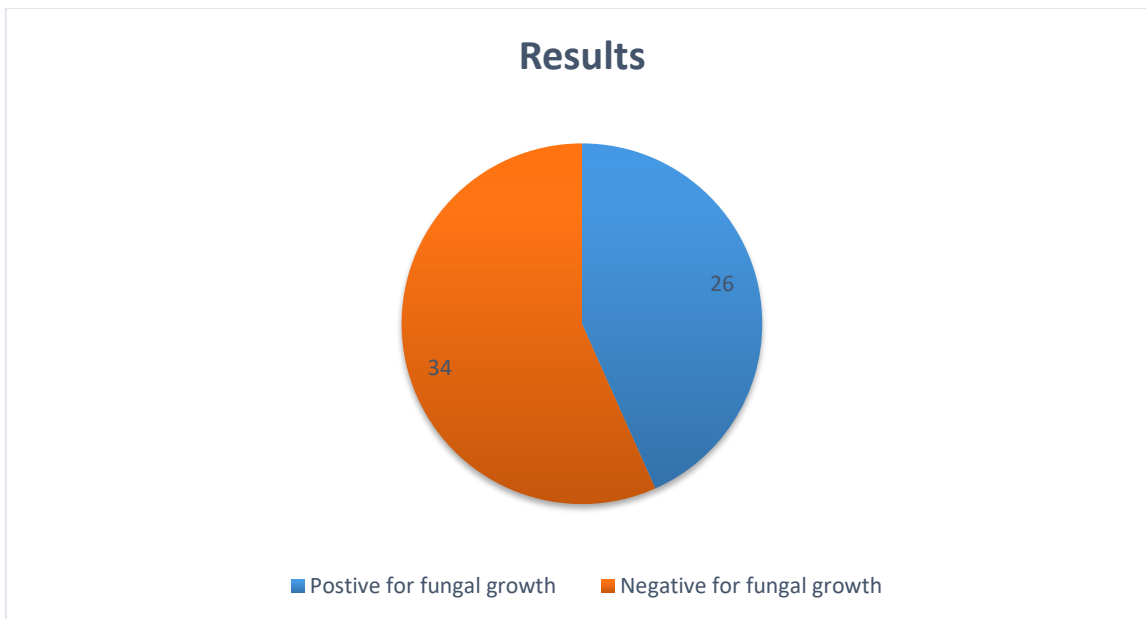


Figure 1: Pie chart depicting the results of the study.

Age groups	Male	Female	Total
21-40	4	1	5
41-60	9	4	13
>60	6	2	8

Table 1: Distribution of positive samples according to age.

Among the positive samples the most prevalent organism was *Candida albicans* (50%) followed by *Candida tropicalis*(15.38%), *Candida* spp. (15.38%), *Candida krusei*(11.53%), *Candida parpsilosis*(3.84%) and *Trichophyton* spp.(3.84%) which is being depicted in figure 2.

Name of the organism	Frequency
<i>Candida albicans</i>	13
<i>Candida tropicalis</i>	4
<i>Candida krusei</i>	3
<i>Candida parpsilosis</i>	1
<i>Candida</i> spp.	4
<i>Trichophyton</i> spp.	1

Table 2: Frequency of the isolated speices.

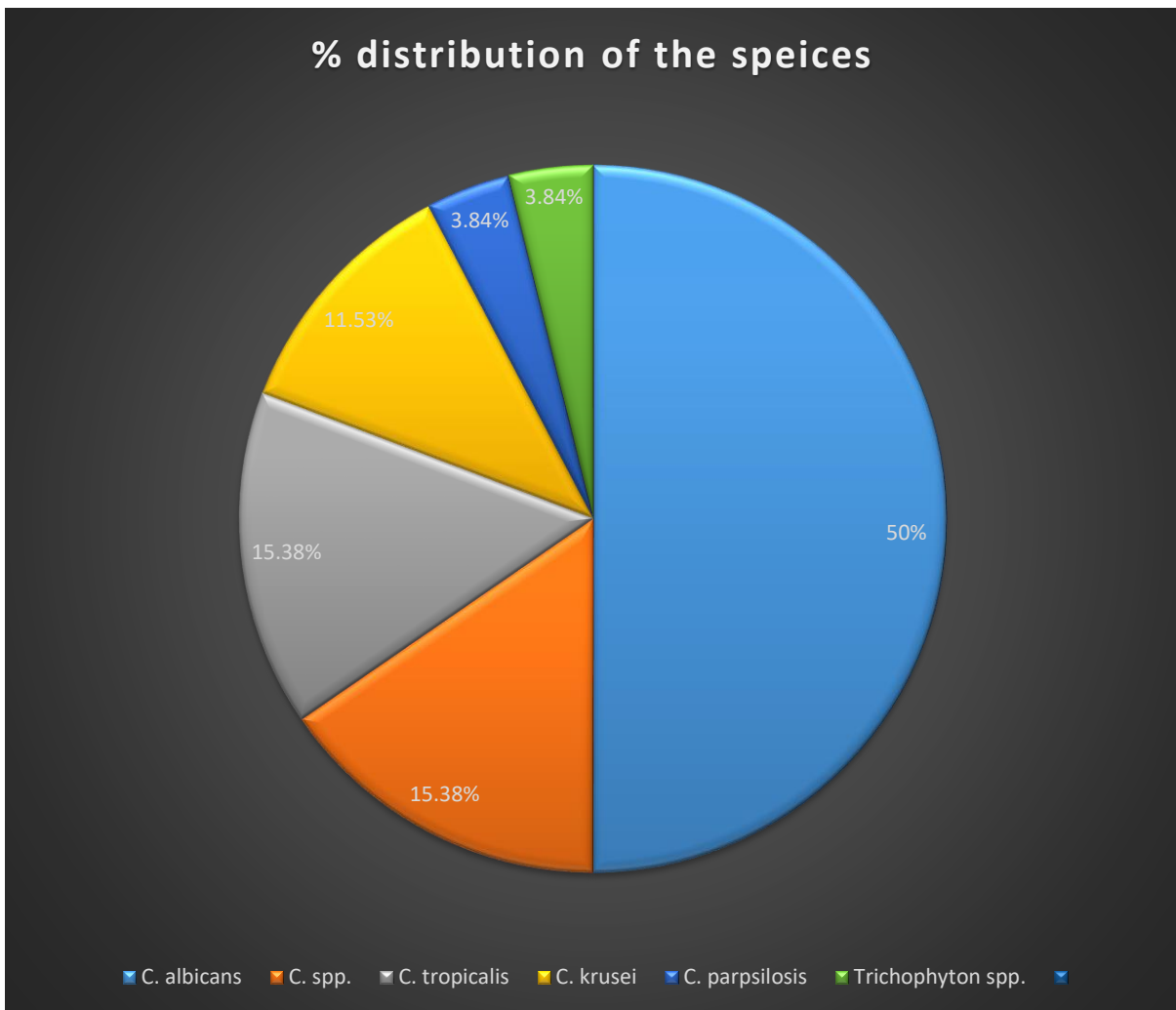


Figure 2: Pie chart depicting percentage wise distribution of the species isolated.

C. = Candida

Out of the 26 positive samples, 11(42.03%) were isolated from patients suffering from Type 1 Diabetes Mellitius and 15(57.69%) from Type 2 as shown in figure 3.

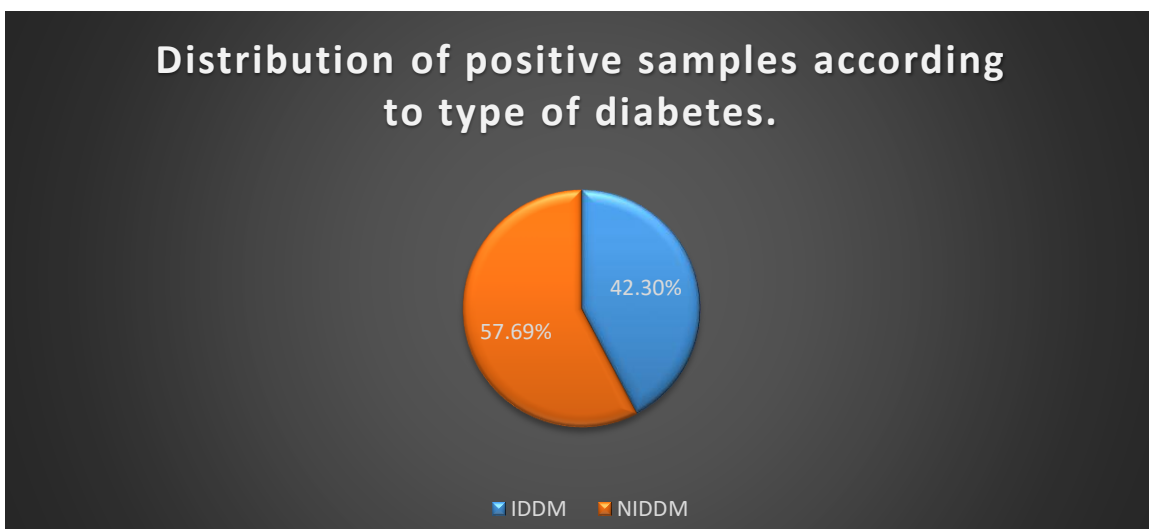


Figure 3: Distitribution of the positive samples according to the type of diabetes from which patient was suffering.

IDDM= Insulin Dependent Diabetes Mellitus

NIDDM= Non Insulin Dependent Diabetes Mellitus

Out of the 26 positive samples, 7 were urine samples, 17 were sputum samples and 2 were skin scrappings as shown in table 3. No fungal species was isolated from the swabs.

Type of sample	Total no. of sample	Samples from males	Samples from females	Positive for fungal growth	Negative for fungal growth	Organisms isolated with it's frequency()
Urine	23	18	5	7	16	<i>C. tropicalis</i> (2) <i>C. krusei</i> (1) <i>C. parpsilosis</i> (1) <i>C. albicans</i> (1) <i>C. spp.</i> (1)
Sputum	24	19	5	17	7	<i>C. krusei</i> (2) <i>C. albicans</i> (2) <i>C. tropicalis</i> (11) <i>C. spp.</i> (2)
Scrapping	2	1	1	2	0	<i>C. spp.</i> (1) <i>Trichophyton spp.</i> (1)
Swab	11	10	1	0	11	-

Table 3: Distribution of the samples according to sex and their types.

C. = Candida

We found that out of the 60 patients, 13(21.67%) patients would get their blood sugar level analysed in every 3-6 months while 5(8.33%) got it analysed once a year and the remaining 42(70%) would only get it checked when the clinical symptoms would appear.

DISCUSSION

The above obtained results clearly indicate that Diabetics are prone to fungal infection as 43.33% of the samples were(n=26) were positive for fungal growth.

Carey IM *et al* in their study found that the prevalence of Type 2 Diabetes(94.27%) was more than that of Type 1 Diabetes(5.72%). We in our study also found that Type 2 Diabetes(66.67%) was more prevalent than Type 1 Diabetes(33.33%) but in our study the prevalence was less in comparison with the study by Carry IM *et al.*^[15]

In our study, the most prevalent species isolated was *Candida albicans*. Similar finding was found in a study conducted by Premkumar *et al.*^[16]

Out of 15 Candida isolates isolated from the patients of Type 2 Diabetes Mellitus 8(57.14%) were *Candida albicans* which is in accordance with the study conducted by Atiken-Saavedra *et al.*^[17]

In various studies, *Candida albicans* was found to be the most prevalent Candida species isolated^[16,17] which can be explained by the observation that with increasing glucose levels, there occurs a compromise in cellular immunity and also there occurs changes in polymorphonuclear cells along with monocytes and lymphocytes.^[4] It has also been observed that with increasing levels of glucose, there occurs an impairment in the ability of the neutrophils to kill the Candida.^[14]

Esmailzadeh *et al* in their study found *Candida albicans* to be the most prevalent Candida species isolated from urine^[17] but in our study we found that *Candida tropicalis*(n=2) and *Candida albicans*(n=2) were equally prevalent. This can be explained by the fact that the excess of glucose in diabetic patient is secreted in urine and on the mucosal surface^[10,11] which can act as nutrient medium for the yeasts and thus provides a microenvironment which is favourable for the growth of organisms like *Candida spp.*^[18,19]

We in our study found that 42(70%) patients were negligent towards their blood glucose level. This can be explained by the fact that maximum of the patients were tribals and illiterate and also they were showing ignorant behaviour by neglecting their health.

CONCLUSION

The present study shows a considerable prevalence of fungal infections among the diabetic patients indicating that diabetics are more prone to fungal infections. The present study concluded that *Candida albicans* was the most prevalent fungal species in diabetics. It is a major health concern as fungal infections in diabetics can range from a minor skin infection to a fatal condition like rhinocerebral mucormycosis. Due to such a considerable prevalence rate, there is a serious need to take preventive measures like educating the people about personal hygiene and to educate them regarding the risk factors of diabetes and thus thereby reducing the disease burden.

REFERENCES

1. Who.int[Internet].WHO|Diabetes programme-World Health Organisation Available from: <https://www.who.int/diabetes/en/>
2. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes estimates for the year 2000 and projections for 2030. *Diabetes Care*.2004;27(3):1047-53
3. Whiting Dr, Guariguata L, Weil C, Shawj. IDF Diabetes atlas: Global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes Res Clin pract*. 2011;94:311-21
4. Calvet H.M., Yoshikawa T.T. Infections in diabetes. *Infect. Dis. Clin. N. Am*. 2001;15:407–421. doi: 10.1016/S0891-5520(05)70153-7.
5. Rodrigues CF, Rodrigues ME, Henriques M. *Candida* sp. Infections in Patients with Diabetes Mellitus. *J Clin Med*. 2019 Jan 10;8(1). pii: E76. doi:10.3390/jcm8010076.
6. Suleyman G, Alangaden GJ. Nosocomial Fungal Infections: Epidemiology, Infection Control, and Prevention. *Infect Dis Clin North Am*. 2016 Dec;30(4):1023-1052. doi: 10.1016/j.idc.2016.07.008 .
7. Rangel-Guerra R, Martínez HR, Sáenz C. Mucormycosis. Report of 11 cases. *Arch Neurol*. 1985;42:578–81
8. Lehrer RI, Howard DH, Sypherd PS, Edwards JE, Segal GP, Winston DJ. *Ann Intern Med*. 93.5th ed. 1980. Mucormycosis; pp. 93–108.
9. Raiesi O, Siavash M, Mohammadi F, Chabavizadeh J, Mahaki B, Maherolnaghsh M, Dehghan P. Frequency of Cutaneous Fungal Infections and Azole Resistance of the Isolates in Patients with Diabetes Mellitus. *Adv Biomed Res*. 2017 Jun 6;6:71. doi: 10.4103/2277-9175.191003. eCollection 2017.
10. Medicalnewstoday.com[Internet]. What's to know about diabetes and yeast infections? [updated 2017 june 13] Available from: <https://www.medicalnewstoday.com/articles/317824.php>
11. Vazquez JA, Sobel JD. Fungal infections in diabetes. *Infect Dis Clin North Am*.1995 Mar;9(1):97-116.

12. Lakshmanan A, Ganeshkumar P, Mohan SR, Hemamalini M, Madhavan R. Epidemiological and clinical pattern of dermatomycoses in rural India. *Indian J Med Microbiol.* 2015 Feb; 33 Suppl : 134-6. doi: 10.4103/0255-0875.150922.
13. Garrison MW, Campbell RK. Identifying and treating common and uncommon infections in the patient with diabetes. *Diabetes Educ.* 1993 Nov-Dec;19(6):522-9;quiz 530-1.
14. Wilson RM, Reeves WG. Neutrophil phagocytosis and killing in insulin-dependent diabetes. *Clin Exp Immunol.* 1986 Feb;63(2):478-84.
15. Carey IM, Critchley JA, DeWilde S, Harris T, Hosking FJ, Cook DG. Risk of Infection in Type 1 and Type 2 Diabetes Compared With the General Population: A Matched Cohort Study. *Diabetes Care.* 2018 Mar;41(3):513-521. doi: 10.2337/dc17-2131
16. Premkumar J, Ramani P, Chandrasekar T, Natesan A, Premkumar P. Detection of species diversity in oral candida colonization and anti-fungal susceptibility among non-oral habit adult diabetic patients. *J Nat Sci Biol Med.* 2014 Jan;5(1):148-54. doi: 10.4103/0976-9668.127315.
17. Esmailzadeh A, Zarrinfar H, Fata A, Sen T. High prevalence of candiduria due to non-albicans Candida species among diabetic patients: A matter of concern? *J Clin Lab Anal.* 2018 May;32(4):e22343. doi: 10.1002/jcla.22343.
18. Huang JJ, Tseng CC. Emphysematous pyelonephritis: clinicoradiological classification, management, prognosis, and pathogenesis. *Arch Intern Med.* 2000 Mar 27;160(6):797-805
19. Grupper M, Kravtsov A, Potasman I. Emphysematous cystitis: illustrative case report and review of the literature. *Medicine (Baltimore).* 2007 Jan;86(1):47-53.