



Identification of *Candida albicans* in the Urine of Type 2 Diabetes Mellitus Patiens at Puskesmas Jaten 2, Karanganyar Regency

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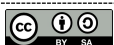
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Abstract

Background: *Candida albicans* is an opportunistic fungus that thrives in environments with high glucose concentrations, which makes patients with Diabetes Mellitus (DM) especially vulnerable to infection. Elevated blood glucose levels in DM can lead to glycosuria, providing a rich nutrient source for fungal growth. This research is critical because there is a lack of specific studies focusing on fungal infections in diabetic patients in Indonesia, despite the increasing prevalence of DM. This research provides a new perspective by highlighting a local diabetic population that has not been extensively studied before. **Objective:** The objective of this study is to identify the presence of *Candida albicans* in the urine of Type 2 Diabetes Mellitus patients at Puskesmas Jaten 2 in Karanganyar Regency. **Materials and Methods:** This descriptive study included 20 urine samples from Type 2 Diabetes Mellitus patients. The inclusion criteria were fasting blood glucose levels of 200 mg/dl or higher, and all patients were enrolled in the chronic disease management program (Prolanis) at Puskesmas Jaten 2. The samples were collected and examined macroscopically in February 2024 to detect the presence of *Candida albicans*. **Results:** The results showed that *Candida albicans* was found in 6 out of 20 urine samples (30%), while the fungus was not detected in 14 samples (70%). The majority of positive cases occurred in patients aged 50 and older, suggesting an age-related susceptibility to fungal infection in this population. Patients with higher glucose levels also showed a greater tendency for *Candida* growth. **Conclusions:** Based on the results of this study, it can be concluded that *Candida albicans* is present in the urine of Type 2 Diabetes Mellitus patients at Puskesmas Jaten 2, with a notable prevalence of 30%. This finding highlights an increased susceptibility to fungal infections in older patients and those with elevated glucose levels, suggesting the need for careful monitoring and potential intervention in this population. Further studies with larger sample sizes are suggested to confirm these results and explore additional preventive measures.

Keywords

Candia albicans, *Diabetes Mellitus*, *Glycosuria*.



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1. Introduction

Diabetes Mellitus (DM) is a group of metabolic disorders characterized by chronic hyperglycemia, which results from inadequate insulin production or impaired insulin action by the pancreas (Asmat et al., 2016). DM is classified into four main types, with Type 2 Diabetes Mellitus (T2DM) being the most prevalent, accounting for approximately 90% of cases (Cole & Florez, 2020). The presence of *Candida albicans* in urine, known as candiduria, is a significant clinical concern, especially in DM patients, because it can lead to severe complications like pyelonephritis, sepsis, and renal dysfunction if left untreated. The high concentration of glucose in diabetic urine provides an optimal growth environment for the fungus, which allows it to proliferate rapidly and invade deeper urinary and renal tissues. Women with diabetes are particularly at risk due to excess glucose in vaginal secretions, which serves as a substrate for fungal growth, further increasing the risk of genital and urinary tract infections (Anwar & Jakaria, 2023; Rodrigues et al., 2019; Talapko et al., 2022).

One significant change is the alteration in the urinary tract environment, such as increased urine acidity or elevated glycogen levels in urethral epithelial cells, which promote the growth of *Candida albicans*. Furthermore, hyperglycemia causes excess glucose to spill into the urine (glycosuria), creating an ideal nutrient-rich environment that enhances fungal proliferation (Bartolo et al., 2021; Behzadi et al., 2015; Man et al., 2017). This relationship between DM and UTIs is compounded by the fact that patients with T2DM often experience reduced immune defense, making them more vulnerable to infections, including those caused by *Candida albicans*.

Although candiduria in diabetic patients is a recognized issue, there is limited data specifically focused on *Candida albicans* infections in T2DM patients in the Jaten 2 area of Karanganyar Regency. The novelty of this research lies in its focus on a localized diabetic population, which has not been extensively studied before. This study aims to fill that gap by providing critical insights into the prevalence and characteristics of *Candida albicans* infections in this region. The results will be essential for developing targeted prevention and management strategies to mitigate the risks associated with fungal infections in DM patients.

2. Materials and Methods

This research received ethical approval from the Health Research Ethics Commission of Muhammadiyah University of Purwokerto, with registration number KEPK/UMP/15/XI/2022. This study employed purposive sampling, with macroscopic testing. Sample collection was conducted at Puskesmas Jaten 2, and testing was performed at the Parasitology Laboratory of Sekolah Tinggi Ilmu Kesehatan Nasional, Surakarta in February 2024. A total of 20 urine samples were collected from Type 2 Diabetes Mellitus patients who met the following inclusion criteria: 1) Patients aged 40-70 years diagnosed with Type 2 Diabetes Mellitus. 2) Fasting blood sugar levels exceeding 200 mg/dl and a history of Type 2 Diabetes Mellitus. 3) Participation in the Prolanis Diabetes Mellitus program at Puskesmas Jaten 2, Karanganyar Regency.

2.1. Equipment and materials

Bio Safety Cabinet (BSC), petri dishes, oshe, test tubes, beaker glass, Erlenmeyer flasks, incubators, digital scales, urine containers, and centrifuges. Materials: urine samples, KOH 10%, CHROMagar Candida (Himedia), disinfectant, and distilled water (aquadest).

2.2. Sample collection

Urine collection began with educating the respondents about the purpose of the urine sample collection and the benefits for them. Respondents were asked to sign an informed consent form to document their agreement to provide fasting urine samples. They were given plastic sample bottles and instructed to clean the genital area before urinating. The midstream urine collection method was explained, in which the initial urine flow was discarded, and the subsequent flow was collected in the sample container. After completing the urination, respondents were reminded to wash their hands with soap.

2.3. Preparation of CHROMagar Candida

CHROMagar Candida was prepared by weighing 33 g of the medium and placing it into a sterile beaker glass. A total of 100 mL of distilled water was added, and the mixture was stirred until fully dissolved. The solution was then homogenized and sterilized in an incubator at 35-37°C for 18-24 h (Mutiawati, 2016).

2.4. Inoculation of samples on CHROMagar Candida

The collected urine samples were centrifuged for 10 minutes. After centrifugation, the sediment was streaked onto *CHROMagar Candida*. The inoculated media were wrapped in plastic wrap and incubated at 37°C for 48 h (Mutiawati, 2016).

2.5. Macroscopic identification

Macroscopic examination of fungal colonies growing on *CHROMagar Candida* was conducted. *Candida albicans* colonies were identified by their characteristic metallic green color, medium size, smooth surface, and convex growth with a well-defined edge.

2.6. Analysis technique

The analysis technique used in this study is descriptive. The data collected from the urine samples of Type 2 Diabetes Mellitus patients, including the presence or absence of *Candida albicans*, were categorized and presented in the form of tables, figures, and detailed explanations of the figures. Quantitative data such as the number of positive and negative cases of *Candida albicans* growth, as well as demographic information (age, blood glucose levels, etc.) were analyzed and organized to identify patterns or trends..

3. Results and Discussion

3.1. Result

Based on the examination results of urine samples from Diabetes Mellitus patients cultured on CHROM agar for Candida (CAC), it was found that 6 urine samples exhibited growth of *Candida albicans*, while 14 other samples showed no growth of *Candida albicans*.

Table 1. Characteristics of Respondents & *Candida albicans* Growth

Patient code	Gender	Age	Blood Glucose Level (mg/dL)	<i>Candida albicans</i>
1	F	53	210	Not Growing
2	F	50	215	Not Growing
3	M	53	200	Not Growing
4	M	64	315	Growing
5	F	60	309	Growing
6	M	70	220	Not Growing
7	M	55	200	Not Growing
8	F	67	232	Growing
9	M	54	207	Not Growing

10	M	45	204	Not Growing
11	M	60	210	Not Growing
12	M	42	204	Not Growing
13	M	52	220	Not Growing
14	F	49	223	Not Growing
15	M	56	236	Growing
16	M	68	307	Growing
17	F	64	202	Not Growing
18	F	46	211	Not Growing
19	F	50	237	Growing
20	F	44	206	Not Growing

The table indicates that the 6 samples showing growth of *Candida albicans* were obtained from patients numbered 4; 5; 8; 15; 16; and 19; with ages of 64; 60; 67; 56; 68; and 50 years, respectively.

The *Candida albicans* colonies that grew on CHROM agar for *Candida* (CAC) are metallic green, medium-sized, convex, and have a smooth surface. The colonies of *Candida albicans* from the study can be seen in the following image.

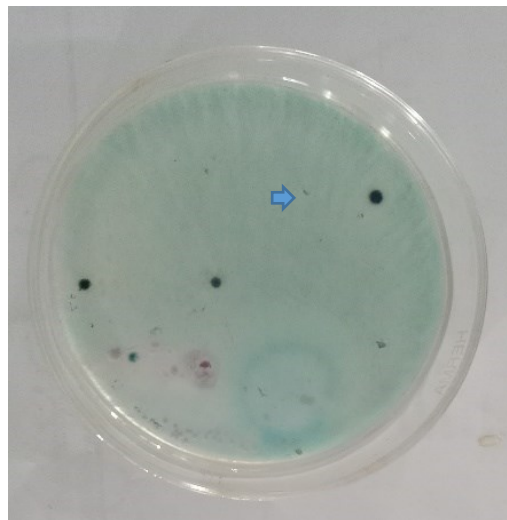


Figure 1. The *Candida albicans* colonies that grew on CHROMagar *Candida* are indicated by arrows.

3.2. Discussion

In this study, *Candida albicans* was detected in 6 out of 20 urine samples (30%), with most positive cases found in patients aged 50 and older. Additionally, patients with higher glucose levels showed a greater likelihood of fungal growth. These results can be compared with the findings from Patricia et al., (2022) where only 2 out of 18 urine

samples (11%) from Diabetes Mellitus patients tested positive for *Candida albicans*, specifically in female patients aged 60-74 years. The lower prevalence of *Candida albicans* in Patricia's study could be attributed to the smaller sample size and the focus on older age groups.

Furthermore, Setia *et al.*, (2023) research in Samarinda found that the majority of Type 2 Diabetes Mellitus patients were aged 45-59 years, with a higher prevalence among females (74%). This is consistent with the current study, where older age was also identified as a risk factor for fungal growth. However, the gender distribution was not emphasized in the current study, which could be explored further to align with Setia *et al.*, (2023) findings that highlight a higher prevalence in women.

These findings may be attributed to the fact that as age increases, aging can reduce the physiological functions of the body, and many non-communicable diseases, such as diabetes, occur in older age. Elderly individuals are a predisposed factor that can trigger the growth of *Candida albicans* due to their poor immunological status. The World Health Organization (WHO) states that after reaching the age of 40, blood glucose levels will rise by 1-2 mg% per year, with an increase of approximately 5.6-13 mg% during fasting two hours after eating. Based on these results, it can be understood that age is also a primary factor in the rising prevalence of Diabetes Mellitus (Bai *et al.*, 2021; Chia *et al.*, 2018; Gunawan & Rahmawati, 2021; Kalyani & Egan, 2013; Komariah & Rahayu, 2020).

This study has several strengths, including its relevance to public health by addressing the risk of *Candida albicans* infections in Type 2 Diabetes Mellitus patients, particularly among older individuals, and its consistency with previous research, which enhances the credibility of the findings. Additionally, the identification of age-related susceptibility to fungal infections provides valuable insights for healthcare providers managing elderly diabetic populations. However, the study also has notable limitations, such as a small sample size that limits the generalizability of the results, a lack of statistical analysis to strengthen the associations between variables, and limited exploration of other risk factors beyond age and glucose levels.

4. Conclusions

Based on the results of this study, it can be concluded that *Candida albicans* is present in the urine of Type 2 Diabetes Mellitus patients at Puskesmas Jaten 2, with a notable

prevalence of 30%. This finding highlights an increased susceptibility to fungal infections in older patients and those with elevated glucose levels, suggesting the need for careful monitoring and potential intervention in this population. Further studies with larger sample sizes are suggested to confirm these results and explore additional preventive measures.

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Conflicts of Interest: No conflict of interest

Author Contributions: Alfina Syalami Hasnayah: Sample collection, writing original draft, performed laboratory work, data analysis. Muhammad Taufiq Qurrohman: Research supervisor.

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