Title: Incidence of Candida Infections in Urinary Tract Among Diabetic Women

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Abstract
Aim This study is done to find out the association of Candida species in urinary tract infections in diabetic women. Objective To evaluate the susceptibility to candida species infection in diabetic patients and to assess the incidence rate. Materials and methodsstudy is done in patients visiting the general OP department. Samples were collected from patients who are clinically proven diabetic. Early morning mid-stream urine samples were collected and transported to the microbiology diagnostic lab. Samples were stored at 4℃. Samples were inoculated on Nutrient agar, MacConkey agar and Sabouraud dextrose agar and incubated at 37℃ for 24 hours. The growth on SDA was identified by gram's staining for the presence of candida. The colonies confirmed for candida were subjected for Germ tube experiment, for the confirmation of C. albicans. The results were tabulated and analysed. RESULTSAmong the total number of 204 patients reported with the symptoms of urinary tract infections, nine of them were positive for candidal infection (10.2 %), including 8 male and 13 female. Candida albicans were isolated from 18 patients (85.7 %) samples and in 3 patient non albicans species.discussion In this study, it is found that candida albicans is one of the common opportunistic pathogens in immunocompromised patients. Conclusion Diabetic patients are more prone to candida infections than other pathogens.
Keywords: Candida albicans; UTI infection; diabetic women; pathogens,innovative technology,novel method.

1. Introduction

Urinary tract infections (UTIs) are caused by microorganisms, usually bacteria that enter the urethra and bladder, causing inflammation and infection. Though a UTI most commonly happens in the urethra and bladder, bacteria can also travel up the ureters and infect the kidneys (Minardi et al.,

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2011).

Urinary tract infections are rare in adult males younger than 50 years but increase in incidence thereafter. Conditions of adult male UTIs include prostatitis, epididymitis, orchitis, pyelonephritis, cystitis, urethritis, and urinary catheters (Odabasi and Mert, 2020). Symptoms of UTI in males of cystitis are frequent urination, persistent urge to urinate (urgency), burning or tingling sensation during or just after urination (dysuria), Low-grade fever, Cloudy urine with a strong odor. Blood in urine (hematuria), trouble urinating, especially if you have a problem with your prostate. UTI Causes and Risk Factors and the most common cause of a UTI in the urethra is a sexually transmitted disease. Chlamydia and gonorrhea are two STDs that can cause a UTI. STDs are also the most common cause of UTIs in younger men. Prostate swelling can be predisposition to UTIs (Hooton, 2010).

UTIs are most common in women because of their susceptibility. Bacteria that live in the vagina, genital, and anal areas may enter the urethra, enters the bladder, and cause an infection. This can happen during sexual activity when bacteria from your partner's genitals, anus, fingers, or sex toys gets pushed into urethra.The symptoms of UTI in females are Pain or burning during micturation.

Urinary tract infections can be induced by stress. Feeling highly stressed is not the direct cause, but it leads to high levels of cortisol, which reduce the effect of the immune system. Social stress produces changes in the bladder over a spectrum ranging from increased urinary frequency with reduced bladder capacity to decreased voiding and an increase in bladder capacity (urinary retention) (Levison and Pitsakis, 1987).

The roles of the host and the pathogens in urinary tract infections. Causes of acquired immunosuppression include immunosuppressive therapies, microbial infections, malignancies, autoimmune diseases, and trauma. Irrespective of the cause, an impaired immune system leads to higher susceptibility to infections(Suzuki et al., 2014). On the other hand, acute rejection requiring an increase in the immunosuppressive medications may result in poor inflammatory response against the bacteria thus predisposing to urinary tract infections as seen in 14.4% of previous study cohort (Esmailzadeh et al., 2018)

UTIs can cause serious problems in the elderly, including permanent kidney damage and sepsis, a generalized and potentially life-threatening infection. Read on to understand how UTIs can affect the elderly and how to recognize symptoms of this common infection.Urinary tract infections are common. But they increase the odds for delirium, hospitalization and death in older adults who are frail (Prasad, 2012) The symptoms of UTI in elderly are Seniors experiencing UTIs can show a sudden change in behavior and symptoms that may appear to be associated with cognitive issues, such as : Frequent falls,Confusion,Dizziness,Agitation or aggression,Fatigue and lethargy,Decreased appetite(Agaçi et al., 2019).

Candida species and in particular, Candida albicans are the most remarkable opportunistic pathogenic fungi causing nosocomial UTIs. Candidiasis is a fungal infection caused by a yeast called Candida. Candida normally lives on the skin and mucus membrane in the body, in places such as the mouth, throat, gut, and vagina, and Ureter. Candida species are the most common cause of fungal urinary tract infections (UTIs). Candida UTIs can occur in the lower portion of the urinary tract or in some cases can ascend up to the kidneys. The following can put you at risk of developing a Candida UTI: having taken a course of antibiotics(Yeshitela, Gebre-Selassie and Feleke, 2012).

C. glabrata and Candida tropicalis are the next most common species found in cultures of urine. Candida parapsilosis, a common cause of candidemia in both adults and neonates, is uncommonly isolated from the urine of adults(Bonadio et al., 2006).

The most common of UTI's is Candida albicans because Immune deficiencies may lead to an imbalance between C. albicans, yeasts and the other host normal flora. In this condition, the commensal yeasts of Candida may convert into opportunistic pathogenic microorganisms creating candidal UTIs in the host('Asymptomatic bacteriuria and urinary tract infections in pregnancy', 2016).

The most common condition to get the Urinary tract infection is Candida Cystitis and pyelonephritis.The urinary bladder may also be infected by Candida spp. Normally, the urinary bladder is sterile, thus, the presence of Candida spp. may lead to Candida cystitis, which is known as a symptomatic lower UTI(Saifuddin, no date).

HIV positive patients are also prone to urinary tract infections. The incidence of urinary tract infections in the HIV population is clearly related to infection and immune function, determined by lymphocytes CD4+ cells count.HIV-positive individuals have a significantly higher risk of having small quantities of a protein in their urine that indicates an increased risk of both cardiovascular and kidney disease, according to American researchers writing in the May 11th edition of AIDS(Diseases et al., 2011).What is the Colour of urine of HIV patient is Red-Brown Urine in a Patient with Chronic HIV Infection and Quadriparesis.Among HIV infected individuals, asymptomatic UTI can progress to symptomatic UTI characterized by mild irritation during voiding to bacteremia, sepsis, and death(Kline and Lewis, 2016).

The most common causes of UTI in kidney transplant patients and the major risk factors for UTI in the kidney transplant recipient include bladder catheters, handling and trauma to the kidney and ureter during surgery, anatomic abnormalities of the native or transplanted kidneys and immunosuppression medication ('Urinary tract infection in patients with diabetes mellitus', 1994). Treatment of UTIs in renal transplant patients is

preferably with fluoroquinolone. TMP-SMX poses the risk of inducing renal failure in the transplanted kidney and consequently should be avoided unless the patient's creatinine clearance is normal. Asymptomatic bacteriuria should be treated for 10 days.Urinary tract infection is the most common infectious complication in kidney transplant recipients with a reported incidence of between 25%-75% (Ankel, Wolfson and Stapczynski, 1990).

UTI is more common in diabetics because the patients with diabetes are more prone to get urinary tract infection due to frequent urination and high blood sugar level. The high sugar level gives a favorable growth environment to the pathogens. Early diagnosis and proper medication are necessary for management of urinary tract infection in diabetic patients.Are diabetics more prone to candida because of Higher levels of glucose in the blood make candida all the more likely, so diabetics who have difficulty controlling their blood sugar may find themselves particularly prone to yeast infections.Diabetes can also lead to kidney complications or increase risk of infections of the urinary tract, both of which can make urine appear cloudy. Urinary tract infections are common complications of diabetes. That's because high blood sugar can lead to sugar in your urine, and sugar is a breeding ground for bacteria. If your bladder doesn't empty completely when you urinate, bacteria can hang around in your urinary tract even longer (Asuke et al., 2020).

The influence of glucose metabolism is seen in many infectious diseases, making diabetic patients more vulnerable to sepsis and other serious sequelae of bacterial invasion. Vaginal candidiasis is a common problem if the glycemia is poorly controlled. The level of glucose concentration in the blood after ingestion of sugar seems to explain an increased likelihood of recurrent infection. Specific immune aberrations, such as an elevated T-helper 2 response and a blunted T-helper 1 response, leading to tolerance, may result in chronic recurrent vulvovaginal candidiasis. In such patients, a low-grade infection with frequent exacerbations is seen, and treatment should be based on 24-hour glycemic control and long intermittent treatment with antifungals. Besides candidiasis, there is also evidence of an increased likelihood of cystitis (Niveditha and Niveditha Niveditha, 2012). Upper urinary tract infections (UTIs) are also a frequent result of bladder colonization. Lethal emphysematous nephritis due to Candida albicans or gas-forming bacteria such as Escherichia coli, Klebsiella, Proteus, streptococci, or enterococci are known to occur in diabetic patients. Furthermore, UTIs in diabetic patients are difficult to eradicate and need longer and intense antibiotic therapy. Awareness of the increased likelihood of UTIs, frequent screening, and prolonged treatment in case of cystitis are warranted. For the prevention of UTI and bacterial vaginal infections estrogen therapy may be as important as antibiotic therapy. Catheterization should be limited since it promotes infection more in diabetic patients than in nondiabetic patients. In the case of recurrent vaginal candidiasis, tight control of glycemia is crucial, in addition to prolonged, intermittent therapy with antifungals(Shrestha, Baral and Khanal, 2019).

Urine test detects Candida are Candida casts in the urine are indicative of renal candidiasis but are rarely seen. With respect to culture, colony counts have not proved to be diagnostically useful. In symptomatic or critically ill patients with candiduria, ultrasonography of the kidneys and collecting systems is the preferred initial study(Patil et al., 2016).

The main diagnostic criteria is the number of organisms per ml. Since urine is a good support medium bacteria can grow easily. Mere presence of an organism is not an indication of infection; thus the count is significant. The most significant bacteriuria is 1lakh bacteria per ml for coliform organisms (Patil et al., 2016; Ramani and Sugil, 2020). The other method is the pour plate method. A Germ tube experiment is done to confirm Candida albicans. All candida isolates are subcultured on Candida indicator media to differentiate the other species.Our team has extensive knowledge and research experience that has translated into high quality publication (Priyadharsini et al., 2018b); (Vijayashree Priyadharsini, 2019); (Paramasivam, Vijayashree Priyadharsini and Raghunandhakumar, 2020); (Priyadharsini et al., 2018a); (Paramasivam and Vijayashree Priyadharsini, 2020); (Paramasivam, Priyadharsini and Raghunandhakumar, 2020) ; (Girija, Shankar and Larsson, 2020); (Jayaseelan and Arumugam, 2020); (Ushanthika et al., 2021); (Ramalingam, Selvi and Jayaseelan, 2019); (Kumar et al., 2020); (Mathivadani, Smiline and Priyadharsini, 2020); (Samuel et al., 2021); (Samuel, 2021); (Barma et al., 2021); (Teja and Ramesh, 2020);(Kadanakuppe and Hiremath, 2016); (Jayaseelan and Paramasivam, 2020); (Jaisankar et al., 2020); (Girija and Smiline Girija, 2021).

The aim of the study is to find out the association of Candida species in urinary tract infections in diabetic women.

2. Materials & Methods

Study is done in patients visiting the general OP department. Samples were collected from patients who are clinically proven diabetic. The patients were informed about the study and after obtaining the informed consent, early morning mid-stream urine samples were collected in sterile disposable plastic containers and transported to the microbiology department. Samples were stored at 4 deg.C till it was processed. Samples were inoculated on Nutrient agar, MacConkey agar and Sabouraud dextrose agar and incubated at 37 deg.C for 24 hours. The growth on SDA was identified by gram's staining for the presence of candida. The colonies confirmed for candida were subjected for Germ tube experiment, for the confirmation of C. albicans. The results were tabulated and analysed.

Sample Collection Method is Urinary tract infection diagnosis method.Early morning first passed mid-stream urine was collected. Refrigerator at 4 - 8 degree celsius. All urine samples were checked with narrow range pH paper. Then 4 - 5 ml of urine is transferred to a test tube and centrifuged at 1500 rpm for 3 mins and the supernatant discarded and the sediments were examined under 45 X objective of the microscope. All samples were screened for the presence of budding yeast and noted. Presence of pus cells is taken as a sign of infection and sepsis.

All the urine samples were inoculated onto Nutrient agar, MacConkey agar, Blood agar and Sabourd's Dextrose Agar. The method used for enumeration is the calibrated loop method. A loop with 4 mm diameter is used to inoculate the samples. The organisms grown were identified based on the standard microbiological protocol. The details of the organisms grown and the colony count were tabulated for analysis.

3. Results

Our present study evaluated the No.of patient samples collected in candida albicans among UTI Infections.

Table 1: Table showing No. of patient's samples collected and candida association

No. patient samples collected	Candidal infection	Percentage association
204	21	10.2

Table 2 : Table showing distribution candida sps association among male and females

Total candida positive	Male	Female
21	8	13

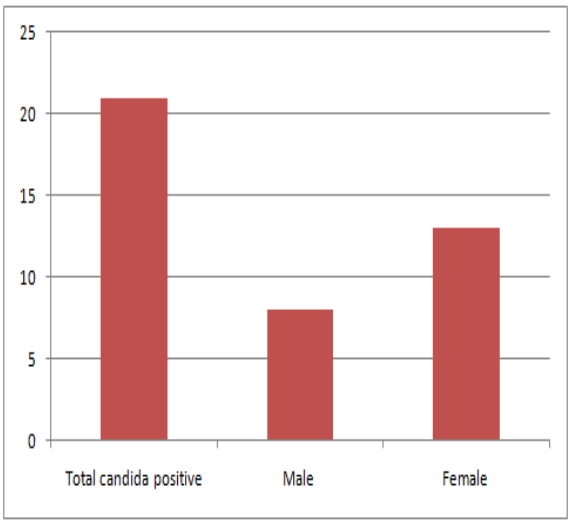

Figure 1: Bar diagram showing total positive, male and female distribution

Table 3 : Table showing candida species association

Species association %	
C. albicans	Non albicans
85.7	14.3

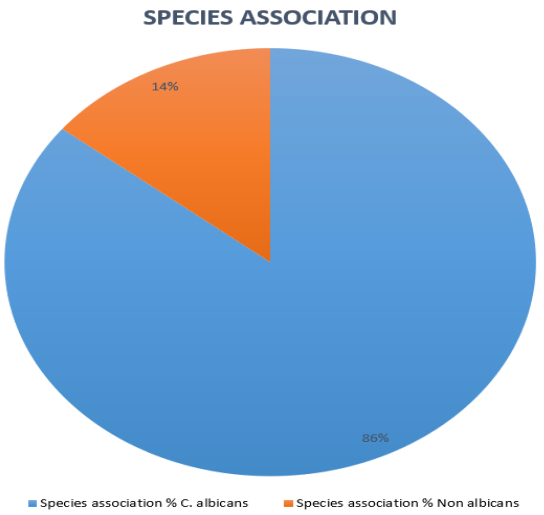

Figure 2: The species association in Candida albicans is depicted in a pie chart. The species association % of candida albicans is 86%, whereas the species association % of non-candida albicans is 14 %.

From the above findings, there were 204 patient samples obtained, with 21 people having candida infection and a percentage association of 10.2. There are a total of 21 candida positive cases, including 8 males and 13 females. The above Bar diagram shows the total positive, male and female distribution (Figure 1). Candida albicans accounts for 85.7 percent of the species association, whereas Non albicans accounts for 14.3% (Figure 2). As a result, the prevalence of candida albicans infection in the urinary tract is high.

4. Discussion

In a cross-sectional study,(Umeh and Emelugo, 2009) determined the fungal causative agents of UTIs in asymptomatic and symptomatic diabetic patients and associated risk factors. Significant candiduria was detected in 7.5% and 17.1% of asymptomatic and symptomatic type 2 diabetic patients, respectively. Among the isolated Candida, sp 84.2% was observed in the asymptomatic diabetic patients and the remaining 15.8% in symptomatic patients (Esmailzadeh et al., 2018).

The colonization of the vagina in prepubertal girls with Candida sp. is rare, as the low estrogen levels during childhood result in a rich anaerobic vaginal flora which inhibits Candida sp. Growth. In a recent report, isolated Candida sp. in 39% of children with type 1 DM between 8–16 years of age. The subjects who had Candida sp. Colonization and candidiasis were considered all acute. C. albicans was found in 50% of all cases, followed by C. glabrata (36.6%), C. krusei (3.3%), and C. dubliniensis (3.3%). Patients with VVC had a greater mean HbA1c when compared to those without such infections, and the authors thus suggested that patients with DM should undergo periodic screening for genital candidiasis. Similarly, Sonck et al.studied the anogenital yeast flora of 166 diabetic girls of less than 15 years of age with vulvitis, revealing that 55% were colonized, mostly by C. albicans (González-Pedraza et al., 2006). Numerous studies have described the higher

prevalence of asymptomatic UTI colonization and symptomatic infection with Candida sp. in diabetic women, and some studies suggest pregnancy as an additional risk factor, although results are inconsistent (Sewify et al., 2015).

A previous study shows that the most predominant UTI's fungal species belonged to the Candida and Saccharomyces genera. In a study of 251 women,(Fonck, 2000)demonstrated that the probability of UTI was 4-fold greater in type 1 DM patients and nearly 2-fold greater in those with gestational DM when compared to healthy pregnant women. The report also highlighted the predominant role of poor glycemic control in the increased prevalence of UTI candidiasis in pregnant women with type 1 DM.In(Chaudhary et al., 2020) determined the prevalence of Candida sp. in Urethra swabs of pregnant women from Serdang Hospital, Selangor, Malaysia, and their antifungal susceptibility. Results showed that 17.2% of the specimens were Candida sp ,C. albicans being the most common species detected (83.5%), followed by C. glabrata(16%) and C. famata (0.05%) (Ghaddar et al., 2020). All C. albicans and C. famata isolates were susceptible to fluconazole, whereas C. glabrata isolates had a dose-dependent susceptibility. The authors concluded that the first trimester, the second trimester, and DM were significant risk factors in patients for the UTI candidiasis ($p < 0.001$). However, other studies noted that DM or impaired glucose tolerance during pregnancy was not connected with UTI candidiasis.('Pathogenesis of bacteriuria in women with diabetes mellitus', 2002). explored the prevalence of VVC in diabetic women versus non-diabetic women and compared the ability of identified Candida sp. isolates to secrete PL and SAPs with the characterization of their genetic profile (Mustafa, 2021). The study involved 80 females with type 2 DM and 100 non-diabetics within the child-bearing period. Results revealed that VVC was significantly higher among the diabetic group (50%) versus the non-diabetic group (20%), and C. albicans was the predominant species in both groups (75% in non-diabetics and 50% in diabetics), followed by C. glabrata (20% in non-diabetics and 42.5% in diabetics). They also found that Candida sp. isolated diabetics secreted higher quantities of proteinase than non-diabetics (87.7% and 65%, respectively), especially for C. albicans and C. glabrata, but non-significant associations between any of the tested proteinase or PL genes and DM were detected(Fisher et al., 1982). These results were—by some means—in agreement with the ones from other reports that also detected C. parapsilosis and C. tropicalis in a group of diabetic women. (Segal, Soroka and Schechter, 1984) detected poor PL production in the isolated Candida sp. (causing vulvovaginitis), of which 81.25% were C. parapsilosis, 30.43% C. albicans, and 18.75% C. glabrata. Moreover, insignificant differences in the expression of Candida sp. PLB1-2 genes and SAP1–SAP8 genes between diabetic and non-diabetic women were reported by Bassyouni and colleagues. Still, they concluded that the higher prevalence of VVC among diabetics could be directly correlated to increased SAPs production. The discrepancies between the results of different reports may be due to changes in growth conditions and host factors that alter the gene expression qualitatively and quantitatively, although findings suggest that the expression of hydrolytic enzymes by Candida sp. is a multifactorial process in patients with DM and the hyperglycemia level is thus not the only implicated factor(Janifer et al., 2009).

5. Conclusion

In the current study it is found that candidal infections are more common in diabetic patients. Since it is an opportunistic infection, the predisposing factors should be given due importance. As this study is conducted in diabetic patients, the factors contributing will be multiple, which are common in any diabetic patients. Candidal infection should be considered as an indicator of the poor resistance and their susceptible conditions to any other infections. It is frequently found in COVID 19 cases that result in haematuria and resulting complications.

It is thus necessary for the physician to examine the patients reporting UTI symptoms in order to gain a better understanding of the causes of the UTI. Attention must be paid to potential predisposition which can work as factors favoring reinfection, because they disturb the normal storage-voiding cycle or reduce body defenses. In particular, any neurologic condition must be taken into account, along with metabolic dysfunction (eg, diabetes), gynecological disorders, and known infectious diseases.

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6. Conflict of Interest

The author declares that there was no conflict of interest in the present study

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Reference

Agaçi, F. *et al.* (2019) 'Urinary tract infections and asymptomatic bacteriuria in diabetic patients with pulmonary diseases', *Problems of Endocrine*

Pathology, pp. 7–17. doi: 10.21856/j-pep.2019.1.01.
Ankel, F., Wolfson, A. B. and Stapczynski, J. S. (1990) 'Emphysematous cystitis: a complication of urinary tract infection occurring predominantly in diabetic women', *Annals of emergency medicine*, 19(4), pp. 404–406.
Asuke, S. *et al.* (2020) 'Prevalence of tuberculosis-HIV co-infection and factors associated with treatment outcome among the tuberculosis patients in an HIV treatment facility in a teaching hospital in Jos, North Central Nigeria', *Port Harcourt Medical Journal*, p. 119. doi: 10.4103/phmj.phmj_14_20.
'Asymptomatic bacteriuria and urinary tract infections in pregnancy' (2016). doi: 10.18591/bjuik.0545.
Barma, M. D. *et al.* (2021) 'Inhibition of Streptococcus mutans, antioxidant property and cytotoxicity of novel nano-zinc oxide varnish', *Archives of oral biology*, 126, p. 105132.
Bonadio, M. *et al.* (2006) 'The influence of diabetes mellitus on the spectrum of uropathogens and the antimicrobial resistance in elderly adult patients with urinary tract infection', *BMC infectious diseases*, 6, p. 54.
Chaudhary, P. *et al.* (2020) 'Prevalence of Non-albicans Candida and its Antifungal Susceptibility at a Tertiary Care Hospital, Jaipur', *International Journal of Contemporary Medical Research [IJCMR]*. doi: 10.21276/ijcmr.2020.7.7.27.
Diseases, T. K. S. of I. *et al.* (2011) 'Clinical Guideline for the Diagnosis and Treatment of Urinary Tract Infections: Asymptomatic Bacteriuria, Uncomplicated & Complicated Urinary Tract Infections, Bacterial Prostatitis', *Infection and Chemotherapy*, p. 1. doi: 10.3947/ic.2011.43.1.1.
Esmailzadeh, A. *et al.* (2018) 'High prevalence of candiduria due to non-albicans Candida species among diabetic patients: A matter of concern?', *Journal of clinical laboratory analysis*, 32(4), p. e22343.
Fisher, J. F. *et al.* (1982) 'Urinary Tract Infections Due to Candida albicans', *Reviews of infectious diseases*, 4(6), pp. 1107–1118.
Fonck, K. (2000) 'Validity of the vaginal discharge algorithm among pregnant and non-pregnant women in Nairobi, Kenya', *Sexually Transmitted Infections*, pp. 33–38. doi: 10.1136/sti.76.1.33.
Ghaddar, N. *et al.* (2020) 'Prevalence and antifungal susceptibility of Candida albicans causing vaginal discharge among pregnant women in Lebanon', *BMC infectious diseases*, 20(1), p. 32.
Girija, A. S. S., Shankar, E. M. and Larsson, M. (2020) 'Could SARS-CoV-2-Induced Hyperinflammation Magnify the Severity of Coronavirus Disease (CoViD-19) Leading to Acute Respiratory Distress Syndrome?', *Frontiers in immunology*, p. 1206.
Girija, A. S. S. and Smiline Girija, A. S. (2021) 'Fox3 CD25 CD4 T-regulatory cells may transform the nCoV's final destiny to CNS!', *Journal of Medical Virology*, pp. 5673–5675. doi: 10.1002/jmv.26482.
González-Pedraza, A. A. *et al.* (2006) '[Urinary tract infection by Candida species]', *Atención primaria / Sociedad Española de Medicina de Familia y Comunitaria*, 38(3), pp. 147–153.
Hooton, T. (2010) 'Urinary Tract Infections in Adults', *Comprehensive Clinical Nephrology*, pp. 629–640. doi: 10.1016/b978-0-323-05876-6.00051-4.
Jaisankar, A. I. *et al.* (2020) 'Molecular characterisation of csgA gene among ESBL strains of A. baumannii and targeting with essential oil compounds from Azadirachta indica', *Journal of King Saud University - Science*, pp. 3380–3387. doi: 10.1016/j.jksus.2020.09.025.
Janifer, J. *et al.* (2009) 'Prevalence of lower urinary tract infection in South Indian type 2 diabetic subjects', *Indian journal of nephrology*, 19(3), p. 107.
Jayaseelan, V. P. and Arumugam, P. (2020) 'Exosomal microRNAs as a promising theragnostic tool for essential hypertension', *Hypertension research: official journal of the Japanese Society of Hypertension*, 43(1), pp. 74–75.
Jayaseelan, V. P. and Paramasivam, A. (2020) 'Emerging role of NET inhibitors in cardiovascular diseases', *Hypertension research: official journal of the Japanese Society of Hypertension*, 43(12), pp. 1459–1461.
Kadanakuppe, S. and Hiremath, S. (2016) 'Social and Behavioural Factors Associated with Dental Caries Experience among Adolescent School Children in Bengaluru City, India', *British Journal of Medicine and Medical Research*, pp. 1–10. doi: 10.9734/bjmmr/2016/24021.
Kline, K. A. and Lewis, A. L. (2016) 'Gram-Positive Uropathogens, Polymicrobial Urinary Tract Infection, and the Emerging Microbiota of the Urinary Tract', *Urinary Tract Infections*, pp. 459–502. doi: 10.1128/9781555817404.ch19.
Kumar, S. P. *et al.* (2020) 'Targeting NM23-H1-mediated Inhibition of Tumour Metastasis in Viral Hepatitis with Bioactive Compounds from Ganoderma lucidum: A Computational Study', *Indian Journal of Pharmaceutical Sciences*. doi: 10.36468/pharmaceutical-sciences.650.
Levison, M. E. and Pitsakis, P. G. (1987) 'Susceptibility to Experimental Candida albicans Urinary Tract Infection in the Rat', *The Journal of infectious diseases*, 155(5), pp. 841–846.
Mathivadani, V., Smiline, A. S. and Priyadarshini, J. V. (2020) 'Targeting Epstein-Barr virus nuclear antigen 1 (EBNA-1) with Murraya koenigii bio-compounds: An in-silico approach', *Acta virologica*, 64(1), pp. 93–99.
Minardi, D. *et al.* (2011) 'Urinary tract infections in women: etiology and treatment options', *International Journal of General Medicine*, p. 333. doi: 10.2147/ijgm. s11767.
Mustafa, K. (2021) 'Isolation and genotyping of Candida albicans involved in vaginal candidiasis among pregnant women in Sulaymaniyah and Erbil cities', *Zanco Journal of Medical Sciences*, pp. 493–502. doi: 10.15218/zjms.2021.012.
Niveditha, S. and Niveditha Niveditha, S. (2012) 'The Isolation and the Biofilm Formation of Uropathogens in the Patients with Catheter Associated Urinary Tract

Infections (UTIs)', *JOURNAL of CLINICAL AND DIAGNOSTIC RESEARCH*. doi: 10.7860/jcdr/2012/4367.2537.
Odabasi, Z. and Mert, A. (2020) 'Candida urinary tract infections in adults', *World journal of urology*, 38(11), pp. 2699–2707.
Paramasivam, A., Priyadharsini, J. V. and Raghunandhakumar, S. (2020) 'Implications of m6A modification in autoimmune disorders', *Cellular & molecular immunology*, 17(5), pp. 550–551.
Paramasivam, A. and Vijayashree Priyadharsini, J. (2020) 'Novel insights into m6A modification in circular RNA and implications for immunity', *Cellular & molecular immunology*, 17(6), pp. 668–669.
Paramasivam, A., Vijayashree Priyadharsini, J. and Raghunandhakumar, S. (2020) 'N6-adenosine methylation (m6A): a promising new molecular target in hypertension and cardiovascular diseases', *Hypertension research: official journal of the Japanese Society of Hypertension*, 43(2), pp. 153–154.
'Pathogenesis of bacteriuria in women with diabetes mellitus' (2002) *International journal of antimicrobial agents*, 19(6), pp. 539–545.
Patil, T. *et al.* (2016) 'A Retrospective Analysis of Prevalence of Uropathogens and Antibiotic Sensitivity Pattern in Patients of Urinary Tract Infection in a Tertiary Care Teaching Hospital', *International Archives of BioMedical and Clinical Research*. doi: 10.21276/iabcr.2016.2.3.14.
Prasad, R. (2012) *Candida Albicans: Cellular and Molecular Biology*. Springer Science & Business Media.
Priyadharsini, J. V. *et al.* (2018a) 'An insight into the emergence of Acinetobacter baumannii as an oro-dental pathogen and its drug resistance gene profile – An in silico approach', *Heliyon*, p. e01051. doi: 10.1016/j.heliyon.2018.e01051.
Priyadharsini, J. V. *et al.* (2018b) 'In silico analysis of virulence genes in an emerging dental pathogen A. baumannii and related species', *Archives of Oral Biology*, pp. 93–98. doi: 10.1016/j.archoralbio.2018.07.001.
Ramalingam, A. K., Selvi, S. G. A. and Jayaseelan, V. P. (2019) 'Targeting prolyl tripeptidyl peptidase from Porphyromonas gingivalis with the bioactive compounds from Rosmarinus officinalis', *Asian Biomedicine*, pp. 197–203. doi: 10.1515/abm-2019-0061.
Ramani, C. P. and Sugil, E. (2020) 'Comparison of antimicrobial susceptibility pattern between biofilm and non-biofilm forming uropathogens isolated from community acquired urinary tract infections', *Indian Journal of Microbiology Research*, pp. 137–141. doi: 10.18231/j.ijmr.2020.025.
Saifuddin, M. (no date) 'Prevalence of uropathogens with sensitivity in diabetic patients with urinary tract infection at Bangladesh'. doi: 10.26226/morressier.5d9b6233ea541d6ca84940c5.
Samuel, S. R. (2021) 'Can 5-year-olds sensibly self-report the impact of developmental enamel defects on their quality of life?', *International journal of paediatric dentistry / the British Paedodontic Society [and] the International Association of Dentistry for Children*, 31(2), pp. 285–286.
Samuel, S. R. *et al.* (2021) 'Dental pain, parental SARS-CoV-2 fear and distress on quality of life of 2 to 6 year-old children during COVID-19', *International journal of paediatric dentistry / the British Paedodontic Society [and] the International Association of Dentistry for Children*, 31(3), pp. 436–441.
Segal, E., Soroka, A. and Schechter, A. (1984) 'Correlative relationship between adherence of Candida albicans to human vaginal epithelial cells in vitro and candidal vaginitis', *Sabouraudia*, 22(3), pp. 191–200.
Sewify, M. *et al.* (2015) 'Prevalence of Urinary Tract Infection and Antimicrobial Susceptibility among Diabetic Patients with Controlled and Uncontrolled Glycemia in Kuwait', *Journal of Diabetes Research*, 2016. doi: 10.1155/2016/6573215.
Shrestha, L. B., Baral, R. and Khanal, B. (2019) 'Comparative study of antimicrobial resistance and biofilm formation among Gram-positive uropathogens isolated from community-acquired urinary tract infections and catheter-associated urinary tract infections', *Infection and Drug Resistance*, pp. 957–963. doi: 10.2147/idr.s200988.
Suzuki, M. *et al.* (2014) 'Effect of SGLT2 inhibitors in a murine model of urinary tract infection withCandida albicans', *Diabetes, Obesity and Metabolism*, pp. 622–627. doi: 10.1111/dom.12259.
Teja, K. V. and Ramesh, S. (2020) 'Is a filled lateral canal – A sign of superiority?', *Journal of Dental Sciences*, pp. 562–563. doi: 10.1016/j.jds.2020.02.009.
Umeh, S. O. and Emelugo, B. N. (2009) 'Incidence Of Candida Albicans Infection Among Women Having Cases Of Vaginal Itching And Discharge In Awka Anambra State, Nigeria', *Tropical Journal of Medical Research*. doi: 10.4314/tjmr.v11i2.30473.
'Urinary tract infection in patients with diabetes mellitus' (1994) *International journal of antimicrobial agents*, 4(2), pp. 113–116.
Ushanthika, T. *et al.* (2021) 'An in silico approach towards identification of virulence factors in red complex pathogens targeted by reserpine', *Natural Product Research*, pp. 1893–1898. doi: 10.1080/14786419.2019.1641811.
Vijayashree Priyadharsini, J. (2019) 'In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens', *Journal of periodontology*, 90(12), pp. 1441–1448.
Yeshitela, B., Gebre-Selassie, S. and Feleke, Y. (2012) 'Asymptomatic bacteriuria and symptomatic urinary tract infections (UTI) in patients with diabetes mellitus in Tikur Anbessa Specialized University Hospital, Addis Ababa, Ethiopia', *Ethiopian medical journal*, 50(3), pp. 239–249.