Detection and Antimicrobial susceptibility of *Candida* species isolated from the urine of patients in a tertiary health facility, southwest Nigeria

ABSTRACT

Aims: This study aimed to identify and determine the antimicrobial susceptibility profiles of *Candida species* resulting in UTI among patients attending a tertiary Teaching Hospital, in southwest Nigeria.

Study Design: Comparative cross-sectional study

Place and Duration of Study: Lagos State University Teaching Hospital, Ikeja, Nigeria between June 2017 and February, 2018.

Methodology:A total of 250 participants whose provisional diagnosis was candiduria were recruited for this study. Urine samples were collected from consenting participants early in the morning into sterile wide mouth universal containers. These samples were cultured aerobically on Blood agar, Cystine-Lactose-Electrolyte Deficient (CLED) agar and Sabouraud dextrose agar (SAB) at 37^0C within 1 to 2 days. The isolates were profiled into species level using microscopic, biochemical test, chromogenic media (Chrom agar Candida) and Analytical Profile Index (API) 32C examination analysis.

Results: An overall rate for Candidiasis in this study was 12.8% (32/250). The rate was higher in female 17.5% compared to 6.5% in their male counterparts (p=0.014). Highest rate of infections peaked at 28.6% among age group 83-92 years and lowest (6.7%) in age group 23-32 years. Eleven (4.4%) of the participants' urine culture yielded pure fungi isolates of *C. albicans*. However, by gender, this was statistically significant (p=0.003). A total of 81 bacterial (32.4%) and fungal isolates 32 (12.8%) were isolated and profiled. Distribution of *Candida species* indicated highest incidence in age bracket 31-40 years, followed by age 21-30years and age 61-70 years. The isolated species were *Candida albicans* 11(34.4%), *C.tropicalis* 8(25%), *C.parapsilopsis* 6(19%), *C.krusei* 2(6.3%) and *C.hellenica* 1(3.1%). Sixty to seventy percent of fungal isolates were susceptible to ketoconazole and fluconazole while the susceptibility pattern of *Candida species* to itraconazole, terbinafine and nystatin varied between moderately susceptible to resistance. All the Candida isolates were resistant to griseofulvin. However, *C. albicans* was found to be the major *Candida species* causing Candidal urinary tract infection. The only *C.hellenica* isolated was resistant to all the antifungal drugs adopted except nystatin.

Conclusion: This study reported high profile of Candida isolates and related UTI microbes. Adoption of API and Chrom agar Candida for routine diagnostic materials for Candida identification is advocated. Moreover, the Candida isolates were mostly susceptible to ketoconazole and Fluconazole but all the isolates were resistant to griseofulvin.

Keywords: Candida; Antimicrobial susceptibility;Sabouraud dextrose agar; Antifungal disc; Nigeria.

1. INTRODUCTION

The detection of candida species in the urine of patients is indicative of colonization with ultimate urinary tract infection (UTI) referred to as candiduria[1]. However, the causative agent of this clinical condition varies according to the geographic region, study period, and type of

healthcare facility. *Candida albicans* is the most prevalent candiduria agent; however, *Candida* non-*albicans* (CNA) species have been reported worldwide[2,3]which calls for serious health concerns. Candida species in measurable quantities in the urine (Candiduria) are found in less than 1% of clean voided specimens in healthy persons, but account for 5% of all urine cultures results in the general hospital setting and 10% of urine isolate in tertiary care facilities. All common Candida species are capable of causing urinary tract infection (UTI), and in many centers worldwide non *Candida albicans* species now predominate [4]. Candida species are unusual cause of UTI in healthy individual but common in the hospital setting or among patients with predisposing diseases and structural abnormality of the kidney and collecting system [5]. In severe systemic episodes of *Candida* infections, management of clinical conditions and enhanced patient survival depend on rapid interventions. Thus, correct identification of the pathogen and administration of specific antifungal therapies are crucial for patient recovery [6,7,8].

The isolation of *Candida* spp. from urine cultures may indicate colonization or urinary tract infection (candiduria), but it may also be a sign of severe systemic candidiasis or candidemia[6,9].*Candida albicans* is the commonest fungus of medical importance. It is ubiquitous in the environment but it may also be transmitted between people directly [3,4]. *C. albicans* is a commensal and constituent of the normal gut flora comprising micro organisms that live in the human mouth and gastrointestine tract. *C. albicans* lives in 80% of the human population without causing harmful effects, overgrowth of the fungus results in candidiasis [1,10]. The growth of Candida is normally kept in check by other bacteria in the body. However, if the bacteria balance is compromised symptoms will arise. Candida normally causes infection in warm and moist areas [11]. Candidiasis can stem from overuse of antibiotics. When antibiotics are prescribed to eradicate injurious bacteria, a lot of friendly flora, for example, acidophilous and bifidous organisms in both intestines are destroyed [12].*Candida* spp. can reach the urinary tract via the ascending route, from the urethra to the bladder, or by hematogenous spread, as *Candida* spp. is filtered by the kidneys and excreted in the urine.

All common Candida species are capable of causing urinary tract infection (UTI), and in many centers worldwide non *Candida albicans* species now predominate [13]. Candida species are unusual cause of UTI in healthy individual but common in the hospital setting or among patients with predisposing diseases and structural abnormality of the kidney and collecting system[14]. The potential of *C. albicans* as urinary tract pathogen is dependent in part on successful colonization of body sites near to or with access to the urinary tract. The organism frequently colonizes the oropharynx, colon and vaginal of healthy humans and can enter the urinary tract by ascending from the perineum (retrograde infection)or by hematogenously seeding the kidney and " spilling over" into the urine (antegrade infection)[12]. Candida species adhere poorly to the bladder mucosa but under conditions of urinary tract obstruction, concomitant bacteriuria or profound immunosuppressive invasion of the bladder wall, ureter and or kidney may subsequently occur [15]. Most patients with candiduria are asymptomatic [6]. Yeast can be detected in urine that is contaminated during collection, in patients who have upper urinary tract infection that developed either from retrograde spread from the bladder or hematogenouse spread from a distant source.

Candiduria occurs much less commonly in adult patients in critical care facilities than in infants where candiduria represent colonization and antifungal therapy is not required[16]. Some small observational studies have found that premature infants who have candiduria, or yeast in the

urinary tract, are more likely to have a widespread infection with a high risk of death or impairment of brain development in children who survive. However, clinicians do not often test for candida in urine due to concern about contaminated samples or inaccurate results [15,16]. Contamination can usually be differentiated from urinary tract colonization or UTI by obtaining and culturing new urine samples to see if yeast persists. In older women, to eliminate contamination by perineal flora, it is necessary to obtain the second urine specimen by sterile bladder cauterization. If the second specimen yields no yeast on culture, it can be assumed that contamination by perineal flora was the cause of candiduria, and no further diagnostic studies are needed [12,16].

Most UTIs due to Candida or episodes of candiduria occur in hospitalized patients with indwelling bladder catheter[17]. It is common in intensive care units (ICUs) and may represent the most frequent UTIs encountered in adult surgical ICU [18]. In United States, the percentage of nosocomial UTIs due to candida species increased from 22% for the period 1986-1989 to almost 40% for the period 1992-1997 [19]. Yeast related UTI are rare in healthy newborns. Candiduria is also reported to complicate urological surgery following the placement of prosthetic devices for major congenital urological malformations [16]. Any Candida specie may be associated with Candiduria and widely variable prevalence data regarding such Candida species and candiduria have been reported[20]. Although, *Candida albicans* is frequently reported as the most prevalent species infecting the urinary tract, non-*Candida albicans* species appear better acclimatized to the urinary tract environment with many studies reporting that greater than 50% of urinary Candida isolates belong to non albicans species[21] while others have identified *Candida glabrata* as the dominant species. *C. glabrata* apparently adapts well to selected urine properties such as substrate availability, osmolarity and pH [22]. For many years *C. albicans* was the most prevalent species isolated from the urinary tract. Dominant patients with candiduria have increased mortality rates when compared with similar patients without candiduria[23,24]. Therefore, this study was designed to detect and profile different species of *Candida* isolated from candiduria occurrences in a tertiary healthcare facility in southwest Nigeria and to evaluate the *antimicrobial* susceptibility profiles of these pathogens to various antifungal drugs.

2. METHODOLOGY

2.1 Study Area

Lagos State University Teaching Hospital, Ikeja, is located in the northern part of metropolitan Lagos and draws its patients from all over the state (Lagos State Website) is owned by the state government as a tertiary health facility for the state University. Ikeja is an outer-ring suburb of the city of Lagos and the capital of Lagos State. It lies 20 km north of Lagos Island. It is situated at 6.59° North latitude, 3.34° East longitude. Lagos state is located on the south-western part of Nigeria, it lies approximately on longitude 3^0 23'45" east and between latitude 6^0 27'11"N. The population of Lagos is about 20 million with an area of 356,861 hectares with a growth rate of 3.2%. Lagos was the former capital of Nigeria and is the most economically viable city in Nigeria in which all tribes from all the country concentrate in it as a business hub having this massive population of 20million inhabitants. It has as much as 37 local governments distributed across land and water.

2.2 Participants

Only the consenting participants were recruited among patients queried for UTI with referral to LASUTH Medical Microbiology Laboratory for urine microscopy, culture and sensitivity. Consenting patients (participants presenting with provisional diagnosis of urinary tract infection (symptomatic and asymptomatic), clinical history of being immunocompromised and from the age of 13years and above were considered. However, patients with no case of UTI and of age 12 years and below were not recruited and excluded from the study.

2.3 Sample Collection

Consenting patients were informed to carefully void early morning (midstream) urine into sterile transparent universal containers using aseptic technique and brought for submission to the laboratory. Each sample was properly identified with the name of each participant, date and time of collection and kept in a refrigerator or in an ice pack box before culturing. All the request forms contained all relevant information (age, sex, and provisional diagnosis, date of admission, clinic / ward, hospital number, Doctor's name, signature, consultant in charge of patient, specimen and investigation required).

2.4 Statistical analysis

Descriptive statistics was used to describe the study characteristics of the participants. Continuous variables were summarized as means, standard deviations (SD) for normally distributed or medians, interquartile ranges [IQR] in the case of skewed data and categorical variables were presented as proportions. The validated data was then transferred into SPSS version 20.0 for analysis. Data was summarized as number and percentages. The percentages of the different types of Candida species generated from the result of the study were compared between different disease conditions using Chi-square and ANOVA test. Statistical outcomes with P-value < 0.05 was considered to be significant.

3. RESULTS

Of the 250 participants involved in this study one hundred and eight (43.2%) were males and 142(57.8%) were females (Table 1). Thirty-two (32) pure fungal isolates were obtained after culturing of the 250 specimens with an overall rate of 12.8%. The rate was higher in female 17.5% compared to 6.5% in their male counterparts. Highest rate of in peaked at 28.6% among age group 83-92 years and lowest (6.7%) in age group 23-32 years. A total 11(34.4%) of the Candida isolates produced germ tubes (Figure 1) and showed apple green colonies on chromogenic medium indicating *C. albicans* or *C. dublininesis* while 21(66.6%) were unable to produce germ tube thus indicating other species of Candida. Also, all the 11 isolates that produced germ tube showed turbidity (growth) when cultured in the Sabouraud dextrose broth at 45^0C for 4-5 days which confirmed *C. albicans.* After identification using Chrom TM candida agar and growth at 45^0C, the isolates included 11 (34.4%) for *Candida albicans,* 2(6.3%) for *C. glabrata,* 6(18.8%) for *C. parasilopsis,* 8(25.0%) for *C. tropicalis*, 2(6.3%) for *C. krusei* and *C. kefry* and 1(3.1%) for *C. hellenica*. Fermentation tests were done on all the 32 Candida isolates and all fermented different sugars thus helped in their identifications (Vide 1-3).

3.1 Specimens Yielding Pathogens

Eighty one (32.4%) pure growth of fungal and bacteria were isolated from urine of 250 participants. Seventy eight (31.2%) cultures of either fungal or bacterial yielded no growth, 65 (26.0%) yielded no significant growth and 26 (10.4%) were mixed growth. Forty nine (60.5%) of the 81 pure growth were bacteria while 32(39.5%) were fungal isolates. The bacteria isolates were *Escherichia coli* 25(51%), *Klebsiella aerogenes* 7(14.3%), *Staphylococcusaureus* 2(4.1%), *Pseudomonas aeroginosa* 7(14.3%), and *Staphylococcus saprophyticus* 8 (16.3%). Of the 32 fungal isolates, 7(21.9%) were from the urine specimens of the male participants while 25(79.1%) were from female participants. One of the 10 (10%) specimens collected from the male participants in the age group 13-22 years yielded fungal growth while 2 (16.7%) of the 12 specimens from female participants in the same age group yielded fungal growth. For participants within the age group 23-32 years, specimens were collected from 21 males but none of them yielded fungal growth while 3(12.5%) yielded pure fungal growths out of the 24 specimens collected from female participants. As regards participants within the age group of 33-42 years, 17 male participants were involved in the study and only one (5.9%) of their specimens' yielded fungal growths while 6 (15.0%) yielded the same growth out of the 40 female specimens collected. Of the age group 83-92, only 1(16.7%) specimen out of the 6 specimens from the male participants yielded fungal growth and the only (100%) specimen from the female participant also yielded fungal growth (Vides 1-3; Table 2).

3.2 Age distribution of participants infected with Candida Species

Atotal of 11 *Candida albicans* were isolated in all the age groups, the highest numbers of the isolates 3(27.3%) were found within the age group 43-52 years. For *C. glabrata*, only 1(50.0%) isolate each was found in the age groups 13-22 years and 33-42 years. One (50.0%) isolate of *C. krusei*was identified each from the age groups63-72 years and 83-92 years and in the age groups 23-32 years and 33-42 years, one (50.0%) isolate of *C. kefyr*was alsoidentified. *C. parasilopsis* had a total of 6 (18.8%) isolates; the highest number 3(37.5%) was recorded in the age group 33-42 years. As regards *C. hellenica,* only one (50.0%) isolate was found, in the age groupof 23-32 years(Vide 5; Table 2 and Figure 2).

3.3 Invitro Antifungal Susceptibility Pattern of Candida Isolates

All the 32 Candida isolates were tested against 6 different antifungal discs; Ketoconazole, Fluconazole, Nystatin, Itraconazole, Terbinafine and Griseofulvin. Seven of the 11 *Candida albicans* isolated were most susceptible to Ketoconazole and 6 of the *Candida albicans* isolated were most susceptible Fluconazole. Two were moderately sensitive to Nystatin and Itraconazole while all the 11 isolates were resistance to Griseofulvin. The 2 *Candida glabrata* isolated were susceptible to Ketoconazole and moderately sensitive to Nystatin. Only one each of the isolates was susceptible to fluconazole, Itraconazole and Terbinafine. Four isolates of *C. parasilopsis* were susceptible to Ketoconazole and 5 of the isolates were susceptible to Fluconazole. Three each of the isolates were moderately sensitive to Nystatin and Terbinafine. One of the two, *C. krusei* was more susceptible to Nystatin, Ketoconazole, Fluconazole and moderately sensitive to Itraconazole. Similarly, only one of the 2 *C.kefyr* isolated was susceptible to Itraconazole. *C. hellenica* was only susceptible to Nystatin while all the fungal isolates were resistant to Griseofulvin (Vide 5; Table 3).

Table 1: Age and Sex Distribution of Fungal Infection of the Urinary Tract Among Participants

Age group (years)	No of male participants tested	No (%) of male participants with fungal infection	No of female participants tested	No (%) of female participants with fungal infection	Total No of participants tested	Total No (%) of participants with fungal infection
13-22	10	1(10.0)	12	2(16.7)	22	3(13.6)
23-32	21	0(0.0)	24	3(12.5)	45	3(6.7)
33-42	17	1(5.9)	40	6(15.0)	57	7(12.3)
43-52	10	2(20.0)	22	3(13.6)	32	5(15.6)
53-62	12	2(16.7)	20	3(15.0)	32	5(15.6)
63-72	23	0(0.0)	12	5(41.7)	35	5(14.3)
73-82	9	0(0.0)	11	2(18.2)	20	2(10.0)
83-92	6	1(16.7)	1	1(100.0)	7	2(28.6)
Total	108	7(6.5)	142	25(17.6)	250	32(12.8)

Chi square 19.8, d.f 6 ; Probability 0.003

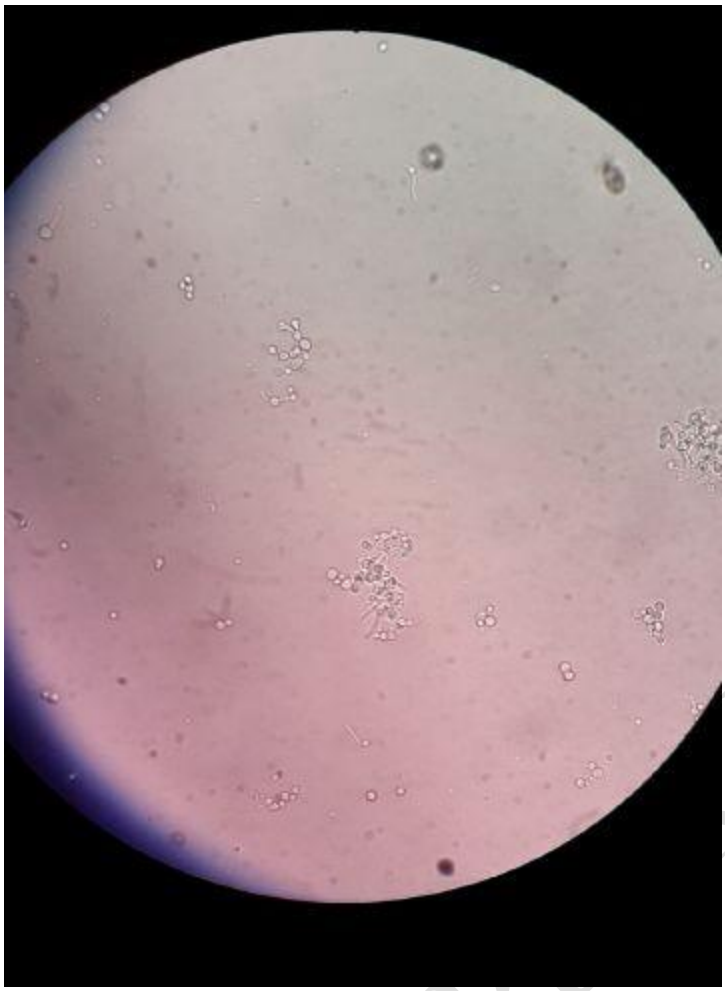

Figure 1: Germ tube indicating *Candida albicans.*

Table 2: Percentage distribution of Candida Species by Age Group

Age Groups	**Organisms Isolated(n=32)**						
(Years)	***C. albicans***	***C.glabrata***	***C.parapsilopsis***	***C.tropicalis***	***C.krusei***	***C.kefyr***	***C.hellenica***
	(%)	**(**%)	**(**%)	**(**%)	**(**%)	**(**%)	**(**%)
13-22	1(9.1)	1(50.0)	0(0.0)	1(12.5)	0(0.0)	0(0.0)	0(0.0)
23-32	1(9.1)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(50.0)	1(100.0)
33-42	1(9.1)	1(50.0)	3(50.0)	1(12.5)	0(0.0)	1(50.0)	0(0.0)
43-52	3(27.3)	0(0.0)	1(16.7)	1(12.5)	0(0.0)	0(0.0)	0(0.0)
53-62	1(9.1)	0(0.0)	1(16.7)	3(37.5)	0(0.0)	0(0.0)	0(0.0)
63-72	2(18.2)	0(0.0)	1(16.7)	1(12.5)	1(50.0)	0(0.0)	0(0.0)
73-82	1(9.1)	0(0.0)	0(0.0)	1(12.5)	0(0.0)	0(0.0)	0(0.0)
83-92	1(9.1)	0(0.0)	0(0.0)	0(0.0)	1(50.0)	0(0.0)	0(0.0)
Total	**11(34.4)**	**2(6.3)**	**6(18.8)**	**8(25.0)**	**2(6.3)**	**2(6.3)**	**1(3.1)**

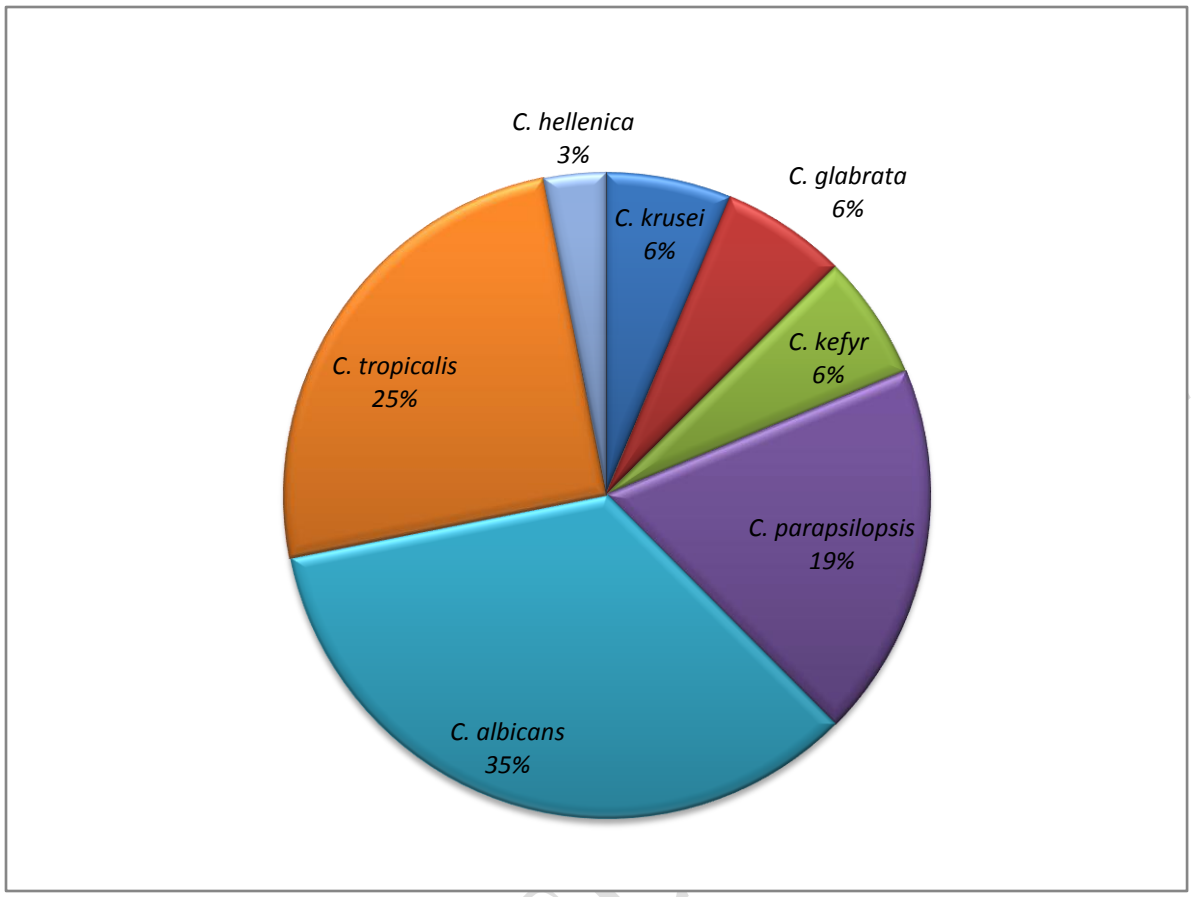

Figure 2: Distribution of 11 Candida species isolated from participants

Table 3: Invitro Antimicrobial Susceptibility Pattern

Candida species	Nystatin			Ketocunazole			Fluconazole			Itraconazole			Griseofulvin			Terbinafine		
	S	I	R	S	I	R	S	I	R	S	I	R	S	I	R	S	I	R
C. albicans(11)	2	6	3	7	2	2	6	2	3	2	5	3	0	0	11	1	4	6
C.glabrata(2)	0	2	0	2	0	0	1	0	1	1	1	0	0	0	2	1	0	1
C. parapsilopsis(6)	2	3	1	4	0	2	5	0	1	2	1	3	0	0	6	0	3	3
C. krusei(2)	1	0	1	1	0	1	1	1	0	0	2	0	0	0	2	0	0	2
C.kefyr(2)	0	2	0	0	0	2	1	0	1	1	0	1	0	0	2	0	0	2
C.tropicalis(8)	2	4	2	5	2	1	2	3	3	2	3	3	0	0	8	2	2	4
C.hellenica(1)	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	1

Key: S-Sensitivity; I- Intermediate; R- Resistance

apiweb - Identification result

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apiweb

ID 32 C V2.0

	0	1	2	3	4	5	6	7	8	9	A	B
	+	-	+	+	-	+	-	-	+	+	+	+
	GAL	ACT	SAC	NAG	LAT	ARA	CEL	RAF	MAL	TRE	2KG	MDG
	SOR	XYL	RIB	GLY	RHA	PLE	ERY	MEL	GRT	MLZ	GNT	LVT
	1	2	4	1	2	4	1	2	4	1	2	4
		5			**5**			**4**			**7**	

	0	1	2	3	4	5	6	7	8	9	A	B
	+	+	-	+	-	+	-	-	-	+	+	+
	GAL	ACT	SAC	NAG	LAT	ARA	CEL	RAF	MAL	TRE	2KG	MDG
	SOR	XYL	RIB	GLY	RHA	PLE	ERY	MEL	GRT	MLZ	GNT	LVT
	1	2	4	1	2	4	1	2	4	1	2	4
		3			**5**			**0**			**7**	

	C	D	E	C	D	E	F
	+	-	-	+	+	+	
	MAN	LAC	INO	MAN	LAC	INO	O
	GLU	SBE	GLN	GLU	SBE	GLN	ESC
	1	2	4	1	2	4	
		1			**7**		

REFERENCE **DATE**
1542 7/15/14
COMMENT

EXCELLENT IDENTIFICATION

Strip ID 32 C V2.0
Profile 5 5 4 7 3 5 0 7 1 7
Note ID.NOT VALID BEFORE 48-H INCUBATION !

Significant taxa	% ID	T	Tests against
✔Candida parapsilosis	99.9	1.0	

Next taxon	% ID	T	Tests against					
Candida famata	0.1	0.29	CEL	91%	RAF	93%	LVT	1%

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Figure 3 Identification results (Vide 1)

apiweb - Identification result

http://localhost/servlet/Ider

apiweb

ID 32 C V2.0

0	1	2	3	4	5	6	7	8	9	A	B
+	+	+	+	+	+	+	+	+	+	-	-
GAL	ACT	SAC	NAG	LAT	ARA	CEL	RAF	MAL	TRE	2KG	MDG
SOR	XYL	RIB	GLY	RHA	PLE	ERY	MEL	GRT	MLZ	GNT	LVT
1	2	4	1	2	4	1	2	4	1	2	4
	7			**7**			**7**			**1**	

0	1	2	3	4	5	6	7	8	9	A	B
+	+	+	+	+	+	-	-	+	-	+	-
GAL	ACT	SAC	NAG	LAT	ARA	CEL	RAF	MAL	TRE	2KG	MDG
SOR	XYL	RIB	GLY	RHA	PLE	ERY	MEL	GRT	MLZ	GNT	LVT
1	2	4	1	2	4	1	2	4	1	2	4
	7			**7**			**4**			**2**	

C	D	E	C	D	E	F
+	-	+	+	+	+	
MAN	LAC	INO	MAN	LAC	INO	O
GLU	SBE	GLN	GLU	SBE	GLN	ESC
1	2	4	1	2	4	
	5			**7**		

REFERENCE 043
DATE 7/15/14
COMMENT

EXCELLENT IDENTIFICATION

Strip ID 32 C V2.0
Profile 7771774257
Note

Significant taxa	% ID	T	Tests against
Candida hellenica	99.9	0.95	

Next taxon	% ID	T	Tests against
Candida ciferrii	0.1	0.26	2KG 100% ERY 100% MEL 75%

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1 of 1

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Figure 4 Identification results (Vide 2).

Figure 5 Identification results (Vide 3).

4. DISCUSSION

This study reported an overall rate of 12.8% candiduria among patients accessing care at Lagos State University Teaching Hospital, Nigeria. This rate was lower than 16.5% candiduria found among similar population admitted in Golestan and Emam Khomeini hospitals of Ahvaz, Iran [9]. An incidence rate of 12.8% of Candida species were reported in this study which correlates with the findings of Richards*et al.*[19] and in contrast with the report of Sehgal, [25] which reported an incidence value of 54% among patients in Northern Nigeria.This study identified eleven (34.4%) for *Candida albicans* while other isolates include 2(6.3%) for *C. glabrata*, 6(18.8%) for *C. parasilopsis*, 8(25.0%) for *C. tropicalis*, 2(6.3%) for *C. krusei* and *C. kefry* and 1(3.1%) for *C. hellenica*. This study revealed a greater proportion of Candida Non Albicans (CAN) isolates from urine samples, which points to the emergence of strains resistant to treatment in the study participants. The presence of candiduria in critically ill patients has been regarded as an indicator of invasive candidiasis(5). However, the high preponderance of CNA as a cause of candidiasis in hospital settings has been observed globally at any site of infection, including the urinary tract[9,26,27]. The importance of this fact is that CNA species are likely to be resistant to antifungal agents, which calls for urgent need to identify various *Candida* species, as well as to assess their susceptibility profile to antifungal agents in hospitalized patients[16,28,29].

In this study, *C. albicans*, *C. tropicalis*, and *C. parapsillosis* were the main isolates. The comparison of the *Candida* species rates found in this study with other previous studies(3,20,30) on candiduria revealed a predominance of *C. albicans* in seven of them[3] and, in the second position, *C. tropicalis* in three studies[3,18,31],the same pattern found in this study. In one study *C. tropicalis* was the most frequent[20]. The prevalence of *C. parapsilosis*, which was 4.7% in our study, in the other studies ranged from zero to 17.4%[3,20,30]. The evaluation of studies carried out in different regions showed a superb relationship in the rates of *Candida* species among studies reported[3,10,20]and those from other parts among themselves[18,20,32]. *C. albicans* is the most frequently found species in the digestive tracts of healthy people, and it has greater pathogenic mechanisms when compared to other*Candida* spp.[20]. Emerging *C. tropicalis* causes urinary tract infections primarily in patients presenting chronic degenerative diseases and/or trauma [29,33].

According to gender analysis of infection in this study, there was a higher preponderance of candiduria in women (34) in which the rate was higher in female 17.5% compared to 6.5% in their male counterparts. Previous studies have demonstrated that as high as 30% of asymptomatic women may experience persistent vulvovaginal colonization by *Candida* spp. This trend aided by the female body conformation may move up to the bladder and kidneys, resulting in urinary tract infections[22,35]. Highest rate of in peaked at 28.6% among age group 83-92 years and lowest (6.7%) in age group 23-32 years. In concordance with other findings, many of our participants are of age indicating that older adults tend to show natural modifications of the immune system, causing longer hospital admissions in critical care units and the need of urinary aided devices[6,27]. Furthermore, of the thirty-two fungal isolates, 7(21.9%) were from the urine specimens of the male participants while 25(79.1%) were from female participants

The prevalence of *C. glabrata* in our study (6.3%) falls within the range of 0 to 12.5 % found in other earlier studies;[20,30,31].The present finding supports previous reports, which

demonstrates that *C. glabrata* has emerged in tertiary hospitals in recent years, both in Nigeria and in other countries[36,37]. The *C. parapsilosis* complex is noted as a primary agent of urinary tract infections in very sick patients under admission due to its capacity to form biofilm [38,39]. Not all categories of the *C. parapsilosis* complex are virulent; among them, *C. metapsilosis* appears to present the lowest virulence, but this evidence is still limited[40]. This calls for differentiating *C. parapsilosis* in clinical studies, including isolates from other anatomic sites[41]. In this study, the six (18.8%) isolates that belong to the *C. parapsilosis* complex were identified as *C. parapsilosis (sensu stricto).*

Many reports have demonstrated the emergence of antifungal resistance, especially Fluconazole (FLC) resistance in *C. albicans* (Odds, 1988[42], however, all of the *C. albicans* isolates were susceptible to Nystatin, Ketocunazole, Griseofulvin and Itraconazole. Moreover, the non-albicans species were also susceptible to the tested drugs, except *C. krusei*, which is intrinsically resistant to FLC. Furthermore, all isolates of *C. glabrata* were also resistant. Resistance to FLC or Nyst has already been reported in *C. glabrata*[5]and *C. tropicalis*[29].In this study, seven of the eleven *Candida albicans* isolated were most susceptible to Ketoconazole and 6 of the *Candida albicans* isolated were mostly susceptible Fluconazole. Two were moderately sensitive to Nystatin and Itraconazole while all the eleven isolates were resistance to Griseofulvin. The two *Candida glabrata* isolated were susceptible to Ketoconazole and moderately sensitive to Nystatin. In South America, some findings from different regions evaluated the susceptibility to FLC of *Candida* species isolated from urine [10,43,44].Adopting the broth microdilution method to evaluate *C. albicans* isolates, one study showed no resistance to FLC [32], as we have found, and another showed 15.0% of resistance 5 thereby corroborating our findings. Applying the disk diffusion method, high rates of FLC resistance were observed[3].Regarding *C. parapsilosis*, there was no resistance to FLC[32] as found this study.

5. CONCLUSION

This study found varying number of species of Candida in the investigated subjects in the urinary system which is of public health importance. Early and accurate species detection, including profiling of antimicrobial susceptibility of isolates, is desirable for evaluation of appropriate therapies for the management of recurrent candiduria and other related fungal infections. The Candida non albicans also cause damages to the kidney and their effects if not handled as early as possible may be more disastrous than the *Candida albicans*. The asymptomatic patients with candiduria should be well evaluated with more caution which should proceed in a logical conclusion [16]. Therefore, the surveillance and effective efficient control measures should be put in place to monitor the trend of the circulation of these pathogens ravaging our communities.

ETHICAL APPROVAL AND CONSENT

Ethical approval was sought and approved before the study started by the LASUTH institutional review board (Reg. No. NHREC04/04/2018) while informed consent was obtained in writing from the participants. All authors declare that all experiments were examined and approved by the appropriate ethics committee and have therefore carried out in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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