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COMPARATIVE ANALYSIS OF PERCENTAGE INCIDENCE OF *Candida* ISOLATES IN SAMPLES OBTAINED FROM HOSPITAL AND COMMUNITY SETTINGS OF NIGER DELTA, NIGERIA

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ABSTRACT

Candidiasis takes many forms, depending on the setting (community or hospital) in which a host became susceptible to these opportunist pathogens. The genus Candida is part of the class blastomycetes and order Saccharomycotina, which live as commensals on mammalian mucous membranes. The study was designed for comparative analysis of the frequency of Candida isolated from community and hospital settings in Rivers State. It was carried out at the University of Port Harcourt teaching hospital, a tertiary hospital facility that accommodates referrals and out patients from all parts of Rivers State and by extension the Niger delta. All samples were inoculated onto a Sarbouraud dextrose agar plate under aseptic conditions according to the procedure outlined by Ochei and Kolhartkar (2001). Germ tube test was also conducted for all Candida isolates. This study intends to evaluate the distribution of Candida isolates from different samples along gender divides. In this present study, the highest prevalence of Candida isolation with in the hospital settings was 27% and 21.6% observed among vaginal swab and urine specimen respectively and the least was 0% seen among the cerebrospinal fluid specimen. However, it was observed that urine and vaginal swab from the community settings showed a high percentage frequency of 26% and 23.3% respectively. Results from this study also showed a generalized percentage frequency of Candida isolation from all the samples put together to be 12.8% (P=0.073) which was statistically not significant. However, the gender distribution of Candida isolates from the different hospital settings samples showed that 50% of Candida isolates from blood samples were derived from male and female samples respectively while cerebrospinal fluid samples had 0% prevalence of Candida isolates and 100% of Candida albicans isolates from stool samples were gotten from female samples only. Likewise, 72.3% of the total Candida isolates from female urine samples obtained from community settings were Candida albicans and 23.7% were Non-albicans Candida while vaginal swab samples had 88.9% of Candida albicans and 11.1% of Non-albicans Candida isolates. Nevertheless, the total percentage gender Candida isolation from urine samples stood at 94.4% for females and 5.6% for males within the community settings while 100% were from female samples for hospital samples. Similarly, out of all the hospital settings Candida isolates generated from this study, 85.2% were Candida albicans and 14.8% were Non-albicans Candida while community settings produced 90.6% Candida albicans and 9.4% Non-albicans candida. Finally, this present study demonstrated that women were more predisposed to Candida infections than men. Nevertheless, necessary steps should be taken to enlighten the public on the various ways of avoiding fungal infections and the use of antibiotics.

INTRODUCTION

Humans will always have to cope with fungal infections because potential fungal pathogens are part of our normal flora and of soil, water, and air (Brooks *et al.*, 2010). Among the estimated 5 million fungal species on planet Earth (O'Brien *et al.*, 2005), only several hundred cause disease in humans, and very few are able to affect healthy people (Cohen *et al.*, 2013). The genus *Candida* is part of the class of blastomycetes and is a polyphyletic group of the order Saccharomycotina, which live as commensals on mammalian mucous membranes, particularly of the gastrointestinal tract (Abbey, 1991). There are no doubt, divided opinions among scholars as to the exact grouping of *Candida* whether it is a commensal or an outright infectious agent since it can remain harmless for long periods and in other instance cause clinical disease in the same individuals (Soll *et al.,* 1991). However, certain conditions may cause a drastic change that can allow *Candida* in the body to grow out of control and this will result in a disease condition generally called candidiasis (Nwafor, 2010). Candidiasis takes many forms, depending on the setting (community or hospital) in which a host became susceptible to these opportunist pathogens. *Candida* species are usually opportunistic organisms (Budtz-Jörgensen, 1990). According to the Mosby's dictionary (2009), community acquired infection is an infection contracted outside a hospital or health care setting or an infection present on admission. However, hospital-acquired infection is an infection whose development is favored by a hospital environment, such as one acquired by a patient during a hospital visit or one developing among hospital staff (CDC, 2015). Community-acquired infections are often distinguished from hospital acquired infections or diseases by the type of organisms that affect patients who are recovering from an illness, disease or injury (Pollack, 2010). With the rise in the incidence of reported *Candida* infections in the developed countries, it is imperative to ascertain the prevalence of *Candida* isolation among different samples collected at different settings in Nigeria. This research aims to analyze and compare the incidence of *Candida* infections in hospital and community settings of Rivers State.

MATERIALS AND METHODS

The study is designed for comparative analysis of the frequency of *Candida* species isolated from community and hospital settings in Rivers State and carried out at the University of Port Harcourt teaching hospital, a tertiary hospital facility that accommodates referrals and out patients from all parts of the Rivers State and by extension the South-South geopolitical zone of Nigeria called the Niger Delta, consisting of six states to include Akwa Ibom, Cross Rivers, Delta, Edo, Bayelsa and Rivers States. All the samples used in this study were collected from routine laboratory samples submitted to the medical microbiology department of the University of Port Harcourt teaching hospital, Alakahia, Obio-Akpo, Rivers state.

EXCLUSION CRITERIA

Samples from patients who are using or have used antifungal drugs for a period less than 14 days before submitting their samples for laboratory processing were excluded from being part of this study.

INCLUSION /CATEGORIZATION CRITERIA

Candida isolates obtained from samples of persons who have not used antifungal drugs for a period of 14 days or more before submitting their samples for laboratory processing were included as part of this study. *Candida* isolates from samples submitted by patients who had not visited the hospital or are admitted into a hospital facility or employed as staff of a hospital/laboratory/biomedical facility for a period not more than 48 hours before sample collection, were classified as community settings *Candida* isolates. Whereas *Candida* isolates isolated from samples produced by patients who had been admitted into a hospital/biomedical facility or are staff working in a hospital/biomedical facility or patient relatives who are care givers to a patient admitted into a hospital/biomedical facility, were regarded as Hospital settings *Candida* isolates.

PROCESSING

All samples were inoculated onto a Sarbouraud dextrose agar plate under aseptic conditions according to the procedure outlined by Ochei and kolhatkar, (2001). *Candida* isolates *were* inoculated on separate sarbouraud dextrose agar plates for purity which is then used for normal saline microscopy, germ tube test, corn meal slide culture and carbohydrate assimilation tests which were performed in line with the set-out procedure of Ochei and Kolhartkar (2001) to confirm *Candida.*

RESULT

This study involved the isolation of 59 *Candida* isolates from 502 samples collected from male and female samples submitted to the medical microbiology laboratory for processing. However, from table 1, the gender distribution of *Candida* isolates from the different hospital settings samples showed that 50% 0f male blood samples used in this study had *Candida* growth while other samples had 0% prevalence of *Candida* isolates except for sputum sample that produced 100% *Candida* isolates from males while 100% of *Candida albicans* isolates from stool samples were gotten from females. Likewise, 72.3% of *Candida albicans were* isolated from female urine samples. However, 23.7% of Non-albicans Candida was also observed as growth from female urine while 88.9% of *Candida albicans* and 11.1% of Non-albicans Candida isolated from vaginal swab samples. Similarly, 50% of isolates from blood sample were derived from samples and an overall study prevalence of 85.2% for *Candida albicans* and 14.8% blood

Table 1: Gender Distribution of *Candida* Obtained From Hospital Settings' Samples

Candida Species	Urine		Stool		Sputum		C s f		Vaginal Swab	Blood		Total Prevalence
	M	F	M	F	M	F	M	F	F	F	M	
	% Frequency											
Candida Albicans	0	72.7	0	100	100	0	0	0	88.9	50	50	85.2
Non Albicans Candida (NAC)	0	27.3	0	0	0	0	0	0	11.1	0	0	14.8
Total	0	100	0	100	100	0	0	0	100	50	50	100

Note: all *Candida* isolates from table 4.4 were expressed in percentage frequency of isolation from the various samples along gender lines. Females were represented as F while males were categorised as M. Perhaps, observations from community settings showed that 13.8% of the total *Candida albicans* isolated from community settings were gotten from male samples while 86.2% were from female samples. Also, 100% of Non-albicans Candida isolated was gotten from female samples. The same was observed for urine (11.1% of Non-albicans isolated) and stool (20% of Non albicans isolated) samples. Similarly, male samples showed 0% of Non-albicans Candida. However, there was observed 40% and 50% *Candida albicans* isolation among the male stool and sputum samples respectively. Alternatively, female samples produced the same percentage of Candida albicans isolation from stool and sputum within the community settings. Nevertheless, the total percentage gender *Candida* isolation from urine samples stood at 94.4% for females and 5.6% for males within the community settings.

Table 2: Gender Distribution of *Candida* Obtained From Community Settings Samples

Species	Urine		Stool		Sputum		Csf		Vaginal Swab		Blood		Total		Prevalence
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
	% Frequency														
Candida Albicans	5.6	83.3	40	40	50	50	0	0	0	100	0	100	13.8	86.2	90.6
Non-Albican Candida (NAC)	0	11.1	0	20	0	0	0	0	0	0	0	0	0	100	9.4
Total	5.6	94.4	40	60	50	50	0	0	0	100	0	100	12.5	87.5	100

Note: all gender categories of *Candida* isolates from table 2 were expressed in percentage frequency of isolation from the various samples along gender lines. Females were represented as F while males were categorized as M.

Collectively, this study demonstrates the presence of 29 *Candida albicans* (90.6%) and 4 Non-albicans *Candida* (9.4%) from the community while hospital settings produced 85.2% of *Candida albicans* and 14.8% of Non-albicans Candida. However, the sample distribution of *Candida* isolates among community setting samples showed a frequency distribution of 26% for sputum samples, 11% for stool, 2% for sputum samples, 20% for vaginal swab samples, 0% for cerebrospinal fluid samples, and 3% for blood samples. The cumulative percentage of *Candida* isolation among community samples was 12.8%. Similarly, sample distribution of hospital *Candida* isolates showed that urine had 21.6%, stool 5%, sputum 3%, vaginal swab 27%, cerebrospinal fluid 0% and blood samples showed 7% of *Candida* growth among the entire samples used for this study while the study percentage frequency for hospital settings samples stood at 10.7%.

DISCUSSION

In the present study, community settings showed that *Candida albican* (90.6%) was the commonest infection and Non-albicans *Candida sp.* (9.4%) was least. Although, *Candida* infections have been less common than bacterial infections, serious *Candida* infections occur in the immunocompromised patient both as new infection and as reactivation of latent disease (Donbraye-Emmanuel *et al.*, 2010). These percentages reported for *Candida albican* (90.6%) for community settings and 85.2% for hospital settings in this study are high compared to 2.0% reported by Choudhry *et al.* (2010), 26.0% reported for *Candida* infection among pregnant women by Donbraye-Emmanuel *et al.* (2010), Nwankwo *et al.* (2010) who reported 70.0% prevalence among females of reproductive age in Kano, Nigeria and 40.0% reported by Oyewole *et al.* (2010) among non HIV-infected women in Sagamu, Ogun state, Nigeria. This high prevalence rate of *Candida albicans* agrees with the the over 90% prevalence reported by Garcia *et al.* (2004) of vaginal candidiasis in pregnant women. In addition, these high rates of *Candida albicans* isolation are in conformity with the fact advanced by Akah et al., (2010) and Nwankwo et al., (2010) that *Candida albicans* is both the most frequent colonizer and responsible for most cases of vulvovaginitis. The study by Nwankwo *et al.* (2010), further demonstrated that regular users of tight clothings had 88.2% of *Candida albicans* and occasional and non wearers had 68.6% of *Candida albicans*. However, the findings of this study indicated that the presence of *Candida albican* and non-albicans *Candida species* in this study was high and could be associated with an increased risk for sexually transmitted diseases among the unsuspecting community populace. The sex distribution of this study revealed that females were more predisposed to acquiring *Candida* infection/colonization than males (Mulu *et al.*, 2013). This may be as a result of their distinct anatomical structural differences (Aaron *et al.*, 2016). Similarly, urine samples also showed the highest percentage isolation of *Candida* species from the community settings. In the same vain, *Candida* isolates across groups showed that the sex distribution pattern of *Candida* isolates from hospital settings, indicating a total number of 27 *Candida* species from a pool of 252 randomized samples that meet the set criteria producing a hospital settings *Candida* species percentage frequency of 10.7% which is statistically significant. There was however, an observed

percentage frequency of *Candida* infection of 21.6% and 27% among urine and vaginal swab specimen respectively within the community settings which was in conformity with the research work published by Donbraye-Emmanuel *et al.* (2010) which reported 26% prevalence among pregnant women. Nevertheless, a low percentage frequency of 0% was observed among the cerebrospinal fluid specimen analyzed for both community and hospital settings of this study. Indicating a near zero infection rate of the cerebrospinal fluid by *Candida* species which could be attributed to the structural anatomical protection given to the cerebrospinal fluid in the body system and its non microbial load. Similarly, it was also observed from this present study that urine and vaginal swab from the community settings showed percentage frequency of 26% and 23.3% respectively which agreed with the 26% prevalence of candidiasis reported by Donbraye-Emmanuel *et al.* (2010) among pregnant women. Although, there were unequal sample size distribution among all the samples used in this study, results from this study showed a general percentage frequency for this study to be 12.8% which was statistically not significant and not comparable with the published research of authors like Nwankwo *et al.* (2010), who reported 70.0% prevalence among females of reproductive age in Kano, Nigeria and 40.0% reported by Oyewole *et al.* (2010) among non HIV-infected women in Sagamu, Ogun state, Nigeria. Therefore, this present study demonstrated that all sexually transmitted diseases need to be properly investigated and treated, since infection with one agent generally increases the chances of infection subsequently with other agents (Jombo *et al.*, 2010; Ryan *et al.*, 1998). This present study showed the presence of 83.3% and 5.6% of *Candida albicans* among the female and male urine samples. In addition, 40% of the total *Candida* isolated from stool samples and 50% of the total *Candida* isolated from sputum samples were from males while 60% and 50% of *Candida* isolates from stool and sputum samples were respectively from females. A result that supports Aaron *et al.*,(2016) assumption that females are more predisposed to *Candida* infections than males. Consequently, this study showed a total gender distribution of *Candida* isolation from all samples used in this study for community settings of 12.5% and 87.5% for male and female samples respectively. The male community settings gender prevalence of 12.5% is not comparable with the rate of detection of *Candida spp.* (29.1%) from specimens in Jos by Jumbo *et al.*, (2010). Also, this finding does not compare well with that of Ekwempu et al., in Zaria who had a prevalence of 20.9% working with samples of women in labour (Ekwempu *et al.*, 1981). However, the female community settings prevalence of 87.5% was higher than the 41% reported by Bello et al., in Nicaragua among women with vaginitis (Bello *et al.*, 2002). While the female urine samples' *Candida albicans* prevalence in this present study was higher than that of Oyelese in Ile-Ife, Nigeria, who reported a prevalence of 24% *Candida albicans* working with samples of people suspected to have had sexually transmitted diseases (Oyelese *et al.*, 2005). Findings from the hospital settings indicated a 72.3% prevalence of *Candida albicans* isolated from female urine samples as comparable with the 70% reported by Nwankwo *et al.* (2010) among samples of females within reproductive age in Kano, Nigeria and 82.3% reported by Mulu *et al.*, (2013) among HIV infected patients presenting late for treatment in Kenya. However, the hospital settings samples' *Candida* isolates also consisted of 23.7% of Non-albicans Candida which was comparable with the 30% Non-albicans Candida reported by Nwankwo *et al.*, (2010). Similarly, the 88.9% of *Candida albicans* was comparable to the 82.3% reported by Mulu *et al.*, (2013) and 11.1% of Non-albicans Candida isolated from vaginal swab samples could not agree with the reports of Oyewole *et al.*,(2010) who reported 40% prevalence among HIV infected women. Similarly, the overall female study percentage of the total *Candida* isolated from blood samples was 85.2% for *Candida albicans* and male percentage of the total *Candida* isolation of 14.8% were obtained from blood samples used in this study. Nevertheless, the percentage for females were not well comparable to the 70% reported by Donbraye-Emmanuel *et al.*, (2010) while the male percentage of the total blood sample *Candida* isolates did not comparable well with the 40.0% reported by Oyewole *et al.* (2010) among non HIV-infected women in Sagamu. From the results of this study so far, we can then put forward that, the observed strong association between vaginal *Candida* colonization with the female gender from this study coupled with the high HIV seropositivity among fertile women with symptomatic candidiasis in Cameroon (Hilber *et al.*, 2010), as well as those of Priotta and Garland, (2006) reported in Melbourne, Australia, where women after taking antibiotic treatment, had higher rates of contracting HIV and the high rates of HIV and candidiasis reported by Chalamilla *et al.*,(2006) among youths and adolescents in Dar es Salaam, Tanzania; suggests that candidiasis could be a significant factor moderating or enhancing the transmission of sexually transmitted infections in patients within the community and hospital settings. This can be attributed to the fact that candidiasis would predispose genitalia exfoliation and sore formation which could enhance the invasive and penetration mechanisms of pathogens into the body

system through their various virulence factors/attributes peculiar to individual microbes.

CONCLUSION

As a matter of fact, the prevalence of *Candida* isolates generated from this study showed a higher incidence of *Candida albican* from community settings than hospital setting, indicating the presence of a large subset of asymptomatic candidiasis within the studied population. But, a higher percentage of non-albicans *Candida* was observed among the hospital settings isolates compared to that of community settings isolates which could be an indication of the emergence of pathogenic non-albicans *Candida* among those sick people receiving treatment from the hospital. Although, extremely high prevalence of *Candida albican* was documented in this study, it was comparable to that found in other parts of the world. Probably, *Candida* infections which occur in varying intensity could depend on the settings the patient was at a given time and could also be as a result of different predisposing factors. In this present study, we have seen the high rate of *Candida* species isolated from female samples and the significant statistical inference observed showing that among the two sex groups there was a significant variation in the *Candida* colonization or infection rates of samples produced by either sex with higher incidence among females. In other words, this study has shown that women are more predisposed to *Candida* infections than men. Also, this study showed a high percentage of *Candida* isolation among urine and vagina swab samples. Similarly, this study was able to highlight the fact that hospital samples have a higher probability of producing Non-albicans Candida species than samples obtained from the community settings. In the same vain, there was observed according to this study that there was a higher percentage of *Candida* isolation among community settings samples than hospital settings samples. This could have been as a result of a cascade of factors. One of which could be attributed to the genitor-urinary anatomical differences inherent between the two gender; distinct societal and God given roles between both gender; the predisposing attitudes and preferences regarding clothing or dress sense, hygiene and general socio-cultural indulgence.

RECOMMENDATIONS

This study has shown that there is the need for hospitals and biomedical facilities to engage in regular and coordinated staff reorientation and trainings. This should also be extended to government agencies and non-governmental agencies with target on the general populace in both community and hospital settings concerning hygiene and infection control modus operandi as the increasing symptomatic vaginal candidiasis from hospital settings samples all points to the fact that candidiasis is an important medical condition that should not be neglected or thrown under the carpet because such action could attract grave consequences which could probably be associated with the increase in rate of transmission of sexually transmitted infections, fallopian tube infection/blockage, infertility in men and women. However, necessary steps should be taken to enlighten the public on the various ways of avoiding fungal infections, especially women, who are the badly hit gender. Therefore, women should be adequately health educated on the need for prompt and timely appropriate investigations and treatment of all uro-genital symptoms and signs at certified health institutions with a high sense of discipline on treatment adherence. This would help in the control of candidiasis as well as other agents of sexually transmitted diseases.

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