

Prevalence of *Staphylococcus aureus* and *Candida albicans* coinfections amongst university community in southwest Nigeria

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Abstract

Background: *Staphylococcus aureus* is a bacterium that is common and frequent polymicrobial pathogen. It constitutes a global burden to human health. Similar characteristic features displayed by *Candida albicans* also causes fungal infections. The interaction generally of the coinfections exhibited is of greater magnitude on these duo microbes at teaching hospitals and big clinical facilities but the extent in the convectonal university is what we cannot really ascertain and this the basis for which the study is done.

Method: We examined the prevalence of *Staphylococcus aureus* and *Candida albicans* on mid steam urine, swabbed wound and high vaginal swabs. Samples were obtained from 520 patients between March 2019 to May 2020 from students and staff of the Federal university of Technology, Akure. Aged 1 to 69 years that visited the medical centre based on complaints and symptoms presented. Laboratory analysis was conducted, the samples were processed, identified microscopically, culturally and biochemically using standard procedures.

Result: The prevalence of *Candida albicans* and *Staphylococcus aureus* coinfection was 2.9% (15) of the 520 participants. Out of which 252 (48.4%) were male and 268 (51.6%) were female. The highest prevalence of 35.8% was observed among the age group (11-20) years.

Conclusion: The prevalence of *Candida albicans* coinfection with *Staphylococcus aureus* is low. The study established it foray in university community. However, initiating prevention strategy with more studies and knowledge of their interactions open a new path to circumvent the prevalence in the next research study.

Keywords: Prevalence; *Staphylococcus aureus*; *Candida albicans*; Coinfection

1. Introduction

Among the vast number of human pathogens, the bacterial species *Staphylococcus aureus* and the fungal species are currently the second and third most commonly isolated bloodstream pathogens [1, 2]. In particular attention *Staphylococcus aureus* has gained considerable attention from the medical community due to its involvement in the increasing number of nosocomial and acquired infection resulting in nearly half a million hospitalization and 50,000 death each year in the USA alone [1, 3]. This bacterial species is armed with an array of virulence factors including toxin and immunoavoidance strategies for invading and destroying host tissue during infection. [4, 5] despite its pathogenic potentials *Staphylococcus aureus* is typically a noninvasive commensal and has been historically identified as a common nasopharyngeal resident but is also found localized associated with moist skin areas of the axillae and groin. However, the microbial species has more recently been found to commonly exist in the oral cavity. *Staphylococcus aureus* typically

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requires a breach. In mucosal barriers to gain entry into the epithelium during infection [6], *S. aureus* produces numerous enzymes such as proteases, lipases, and elastases that enable it to invade and destroy host tissues and metastasize to other sites. *S. aureus* is also capable of producing septic shock. It does this by interacting with and activating the host immune system and coagulation pathways [7, 8, 9] *Staphylococcus aureus* has numerous mechanisms to produce disease and to evade host defences, however it is important to note that not all *S. aureus* are created equal, different strains may contain different adhesions or toxins or may differ in their ability to produce biofilms and resist phagocytes [10].

Similarly, *Candida albicans* is the most frequently encountered pathogenic human fungal species and commonly colonizes host mucosal and moist skin surfaces [11] *Candida albicans* colonizes the oral cavity, vagina and gastrointestinal tract in most humans [12]. It is however also an opportunistic pathogen, able to cause both superficial and systemic infections, the latter mainly in immunocompromised patients. In certain niches of the host, *C. albicans* co-exists with commensal bacteria, including *Staphylococcus* species [13]. A vast number of infections including those of *Candida albicans* and *Staphylococcus* species originate from biofilms and they are often associated with high mortality rates [13] *C. albicans* and *Staphylococcal* species were co-isolated from various biofilm associated diseases, including urinary tract, burns, wound infections, denture stomatitis and infections of medical devices such as central nervous catheters [14, 15]. The complexity of these polymicrobial infections poses an additional challenge to find efficient treatment strategies [16]. Approximately 75% of all women experience at least one episode of vaginal candidiasis and 40 -50% will have recurrent episodes in their life time [17, 18].

2. Material and methods

Study population. In this study a cross sectional design was conducted between March 2019 to May 2020. A total of 520 samples comprising 252 male and 268 female of students, staff and their dependents in the Federal university of Technology Akure Nigeria. Aged 1 to 69 years with complaints and symptoms from the subjects were presented at the university Medical Center.

Laboratory Diagnosis; Sterile universal bottles, sterile swab sticks were used to void mid stream urine, swabbed wound and vaginal swabs were collected from the subjects. Without delay the samples were assayed. Samples cultured on Mannitol salt agar (MSA), MacConkey Agar, Blood agar in the case of urine and wound swab and Sabouraud dextrose agar (SDA) for vaginal swab. The agar plates were incubated in an incubator at 37°C for 24 hrs while SDA incubated at 35°C after 24 hrs incubation. Pure culture were obtained by streaking colony on Nutrient agar and SDA until single colonies were obtained after incubation. All tests were performed using the method of Cheesebrough, 2006 [19]. Wet preparation of the vaginal swabs was made with 10% potassium hydroxide. The growth and colony color examined and identification test performed viz a viz; gram stain, coagulase test, and catalase test for *Staphylococcus aureus* using standard procedures. Germ tube test in serum was used to identify *Candida albicans* at 37°C

3. Results

Table 1 Age range data distribution

Age	No of samples	Percentage (%)	<i>S. aureus</i> & <i>Candida albicans</i>
0 – 10	24	4.6	-
11 – 20	186	35.8	6
21 – 30	164	31.5	4
31 – 40	75	14.4	3
41 – 50	40	7.7	2
51 – 60	22	4.2	-
61 – 69	9	1.8	-
Total	520	100	15

During the study period 520 samples were analyzed from the patients with signs and symptoms i.e. itching, vagina discharge and pain in urination. Of them 15(2.79%) had *Candida albicans* coinfections *Staphylococcus aureus*. 252 (48.4%) were male and 268 (51.6%) were female. The highest prevalence of 35.8% was observed among age group (11 -20) followed by 21 -30 (31.5%) and 31 -40 (14.4%) as indicated in Table 1. The sex distribution by Male is illustrated in Table 2 with age group 11 -20 years had highest prevalence.

Table 2 Sex Date Distribution (Male)

Age	Number of samples	Percentage (%)	<i>Staphylococcus aureus</i> (%)	<i>Candida albicans</i> (%)
0 – 10	13	5.1	2	-
11 -20	88	35.0	8	2
21 – 30	80	31.8	4	1
31 – 40	35	13.8	3	1
41 – 50	19	7.6	2	-
51 – 60	10	4.0	2	-
61 – 69	7	2.7	-	-
Total	252	100	21	4

Table 3 Sex Data Distribution (Female)

Age	Number of samples	Percentage (%)	<i>Staphylococcus aureus</i>	<i>Candida albicans</i>
0 – 10	11	4.1	1	-
11 -20	98	36.6	10	11
21 – 30	84	31.3	7	7
31 – 40	40	15.0	5	3
41 – 50	21	7.9	4	2
51 – 60	12	4.4	2	2
61 – 69	2	0.7	-	-
Total	268	100	29	25

4. Discussion

Candida albicans and *Staphylococcus aureus* had been isolated from several clinical specimens from different part of Nigeria [20] and different part of the world [21, 22]. The current study therefore, study the prevalence of *Candida albicans* and *Staphylococcus aureus* coinfection in the convectional university which is low according to the study is 2.9%. This is in tandem with other researchers that it varies from 1 to 10% prevalence of *Candida* coinfection. Notable country around the world that this statement collaborates with was reported by China [23] (2.2%) Tunisia [24] and United States of America (USA) [25] what reason could be attributed to this? It could be multifactorial ranging from immune status of the patients, hormonal influences, and hygiene and socio- demographic characteristics. Although data on the clinical relevance of bacteria-fungi interactions are limited, several studies have described the association of bacteria and *Candida* species in a range of clinical specimens which varies between countries, depending on the country, region and populations [28, 29, 30]. This study conformed with the findings according to Adad et al., 2001 and Alli et al., 2011 [26, 27] that infections by *Candida* species were most frequent among younger patients especially those ages under 20 years. Table 2 and Table 3 attested to it. 35% of the Male (88/252) were in the age bracket of 11 – 20 years. So also, in Table 3 where 36.6% of the female participants (98/268). Even the *Staphylococcus aureus* isolated were more in that age group although more female were infected with *Candida albicans* than the male as shown in the tables.

5. Conclusion

The study revealed low rate of *Candida albicans* coinfection with *Staphylococcus aureus* in a convectional university community, especially amongst young youth that are prone and vulnerable to infection due to youthful exuberance and sexual behaviors. Intensify good hygiene, environmental sanitation and in-depth insights on their interactions is a novel step to open up further study.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that they have no competing interests.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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