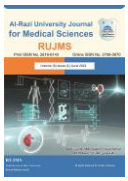
Original Research *Al-Razi Univ J Med Sci 2021; 5(2)*

RUJMS

Al-Razi University Journal of
Medical Sciences



Prevalence and Antifungal Susceptibility of *Candida* species Causing Vaginitis among Pregnant Women in Hajjah Governorate, Yemen

Wadhah Hassan Edrees[1,2*,] Mohammed Alshwmi[1], Bashir Ahmed Al-Ofairi[3]

[1]*Medical Microbiology Department, Faculty of Applied Science, Hajjah University.*
[2]*Medical Laboratory Department, Faculty of Medical Sciences, Al-Razi University.*
[3]*Biology Department, Faculty of Science, Sana'a University, Yemen.*

***Corresponding** *Author: Wadhah Hassan Edrees e.mail: wadah.edrees@alraziuni.edu.ye; edress2020@gmail.com.*

Abstract

Background: *Candida* species, an opportunistic yeast, are the second commonest affecting the genitourinary tracts in females and causing vulvovaginal candidiasis. **Aims**: This study aimed to determine the occurrence of *Candida* species causing vulvovaginal candidiasis among pregnant women in Hajjah governorate, Yemen. Methods: A total of 50 vaginal swab specimens were collected and cultured on Sabouraud dextrose agar. The identification of *Candida* species and antifungal susceptibility testing was done according to standard microbiological procedures. **Results**: The results showed that 70.45% were positive for *Candida* species. It was found that the C. albicans was (68.3%) the most common species isolated while the *non-Candida albicans* was 32.26%. Also, it was recorded that the highest prevalence of *Candida* species was within-group aged 20-24 years. Similarly, the participant woman coming from rural areas had higher vulvovaginal candidiasis than from urban areas. A higher frequency of vulvovaginal candidiasis was observed among participated women with secondary a certificate, third trimester, paucipares (1-2 birth), and recurrent infection. Also, the pregnant women who complained of itching, burning, and discharge had a high rate of vulvovaginal candidiasis. Susceptibility tests revealed that the most isolated species of *Candida* were sensitive to fluconazole and nystatin as well as amphoteracin B. **Conclusion**: It can be concluded that vulvovaginal candidiasis is quite common in Yemen country with a high prevalence. Also, the fluconazole remains the effective agent against all isolates *Candida* species.

Keywords: Antifungal, *Candida* and *Non-Candida* albicans, Hajjah, pregnant Woman, Yemen

Introduction

Candida vaginitis is the infection of the vagina by several types of *Candida* species, also often called vulvovaginal candidiasis/candidosis[1,2]. Vulvovaginal candidiasis (VVC) considered to be the most common manifestation of genital candidiasis[1,3]. Also, the risk factors associated with an increased rate of VVC in pregnant women are immunologic alterations, increased estrogen levels, and increased vaginal glycogen production mechanism[3].

It is representing over 25% of infectious vaginitis[4,5]. 75% of women are affected by vulvovaginal candidiasis in their lifetimes[3]. Also, it was found that more than 40% of affected women will have 2 or more vulvovaginal candidiasis episodes[6,7]. Clinical manifestation of vulvovaginal candidiasis is pruritus, vaginal discomfort, burning, and

soreness[8].

The distribution of *Candida* sp. in vulvovaginal candidiasis cases differs widely depending on the geographical location and population studied[9]. Some reports have documented that among women with acute vulvovaginal candidiasis were caused by *C. albicans* that accounts for 80-90% of all vaginal candidiasis cases, whereas other species are less frequently isolated[1,10,11].

However, in the last years, different species of *Candida* non-albicans are *C. parapsilosis, C. glabrata, C. krusei, C. lusitaniae, C. tropicalis, C. dubliniensis,* and *C. guilliermondii* isolated from vaginal samples[12,13,14]. Misuse of antifungal drugs and lack of effective policies that control the use of antifungals, especially against the vulvovaginal candidiasis lead to increase the resistance of *Candida* species to several antifungal drugs[15].

Few reports documented the prevalence of vaginitis in Yemen. A study by AL-Haik and Al-Haddad[16] reported that 39.2% of pregnant women have been infected by bacterial vaginosis in Hadhramout city. Also, the frequency of vulvovaginal candidiasis was 61.5% reported among pregnant women in Ibb City[17].

A study, in Sana'a, by Abdul-Aziz *et al.*,[18] revealed that the prevalence of vaginal infection between reproductive-aged women was 37.6% of collected samples. The results showed that 27.2% by bacterial vaginosis, 6.6% by vulvovaginal candidiasis, and 0.9% by trichomonal vaginosis. Also, In Sana'a city, the prevalence rate of VVC was 51.6% documented among pregnant women attending healthcare centers[19].

Hajjah governorate is one of the Yemen governorates that lack data on the infectious diseases prevalent among the community particularly vulvovaginal candidiasis among pregnant women caused by *Candida* species and their antifungal susceptibility pattern. In view of this, the aim of the current work aimed to determine the prevalence of *Candida* species that causes vulvovaginal candidiasis among pregnant women and antifungal susceptible patterns of isolated species to antifungals in Hajjah City, Yemen.

Materials and Methods

Study design and area

This study is a cross-sectional study conducted at AL-Gumhorri hospital located in Hajjah city which is located 127 kilometers northwest of Sana'a capital of Yemen, at an elevation of about 1800 meters. The experimental work was performed at the microbiology laboratory at AL-Gumhorri hospital, Hajjah city.

Ethics approval and consent to participate

This study was conducted after it was ethically reviewed and approved by the Ethical Review Board of the Department of Medical Microbiology, Faculty of Applied Sciences, Hajjah University. Also, written consents were obtained from voluntary participants.

Data collection

Prior to the specimen collection, the socio-demographic and health characteristics such as age, resident area, education status pregnancy status, pregnancy trimester, parity, recent use of antibiotics, infection frequency were collected by face- to- face interviews using a structured questionnaire. Also, clinical signs and symptoms of vaginal abnormalities such as itching, burning, and vaginal discharge were recorded.

Sample collection

Forty-four (44) swab specimens were collected from pregnant women seeking the Obstetrics and Gynecology department at AL-Gumhorri hospital

during the period between March to June 2021.

Vaginal swabs were collected from the pregnancy-woman patients by the obstetrician by using the moisten sterile cotton swab that was inserted carefully into the upper part of the vagina. All collected vaginal swabs were transferred immediately to the microbiology laboratory for examination[3,20].

Examination of Specimen

Microscopic examination

The first swab was subjected to wet mount examination. One drop of normal saline was added to each sample and shaking vigorously and examined microscopically under 10x and 40x[21].

Culture methods

The specimen was cultured individually on the surface of Sabouraud Dextrose Agar (SDA) (Himedia, India) supplemented chloramphenicol (250mg/L) and incubated aerobically at 37°C for 48 h. The colonies of *Candida* species were identified depending on morphological features on a culture medium and conformed by observing the budding characterization with pseudohyphae by using the Gram tube test germ tube formation[22].

Germ tube test

A small portion was taken from a pure colony of *C. albicans* by sterile loop and inoculated into sterile tubes containing 0.5ml of human serum. The tubes were mixed and incubated aerobically for 2h at 37°C. One drop of each serum was transferred to a clean slide and examined by microscope under high power (x40) to detect the presence of germ tubes that are short hyphal initials[23].

Antifungal susceptibility testing

The isolated *Candida* species were subjected to susceptibility antifungal agents by using a disc diffusion method on the surface of Mueller Hinton agar + 2% Glucose + 0.5 mcg/ml methylene blue dye medium. The antifungal discs used were Amphoteracin-B (50 µg), Fluconazole (25µg), and Nystatin (NS, 100 units) (Himedia, India). The inhibition zone was measured after 48h of incubation at 37°C[24].

Results

Results

The socio-demographic characteristics of participated pregnant-woman are summarized in Table (1).

The result from the current study revealed that only 31(70.45%) specimens were showed positive growth in culture media and 13(29.55%) specimens were reported negative growth in culture media as shown in Figure (1).

Figure (2) shows the type of *Candida* species causing vaginitis among pregnant women. It was found that the *C. albicans* was 21(67.74%) while the non-*Candida albicans* was 10(32.26%) reported among pregnant women.

Table 2 shows that the highest prevalence of *Candida* infection was 12(38.71%) recorded within the age range of 20-24 years, followed by a group aged between 25-29 years (25.81%). Also, most vulvovaginal candidiasis is caused by *C. albicans* with a rate of 67.74%.

From the 31 positive isolates of *Candida* species, it was found that the highest prevalence of vulvovaginal candidiasis was among women from rural 10(76.92%) compared to women from urban 21(67.74%) areas as shown in Figure (3).

Table (1): Socio-demographic of participated pregnant-woman in study

Variables		No. examined	Rate (%)
Personal characterization			
Age group (in years)	16-19	4	9.09%
	20-24	13	29.56%
	25-29	12	27.27%
	30-34	7	15.90%
	35-39	8	18.18%
Resident area	Rural	13	29.56%
	Urban	31	70.45%
Educational status	Illiterate	9	20.45%
	Primary	7	15.91%
	Secondary	16	36.37%
	Graduate	12	27.27%
Gestational trimester	First trimester	12	27.27%
	Second trimester	11	25.0%
	Third trimester	21	47.73%
Parity	Paucipara (1-2 birth)	23	52.27%
	Multipara (>2 births)	21	47.73%
Infection frequency	First time	7	15.91%
	Recurrent	37	84.09%
Recent Use of antibiotics	Yes	39	88.64%
	No	5	11.36%
Clinical signs and symptoms			
Itching	Yes	42	95.45%
	No	2	4.55%
Burning	Yes	42	95.45%
	No	2	4.55%
Discharge	Yes	41	93.18%
	No	3	6.82%
Diabetes mellitus	Yes	0	0(0)
	No	44	100%

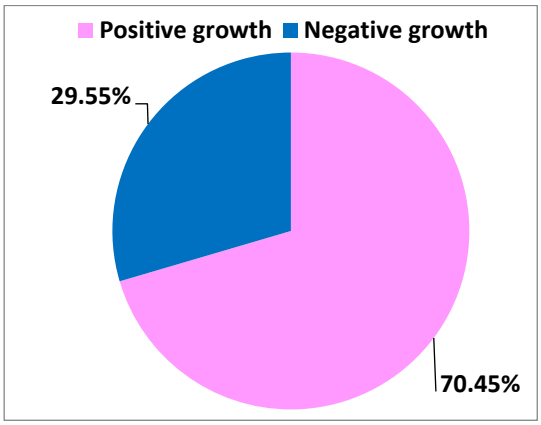


Figure 1: The specimens growth result in culture media

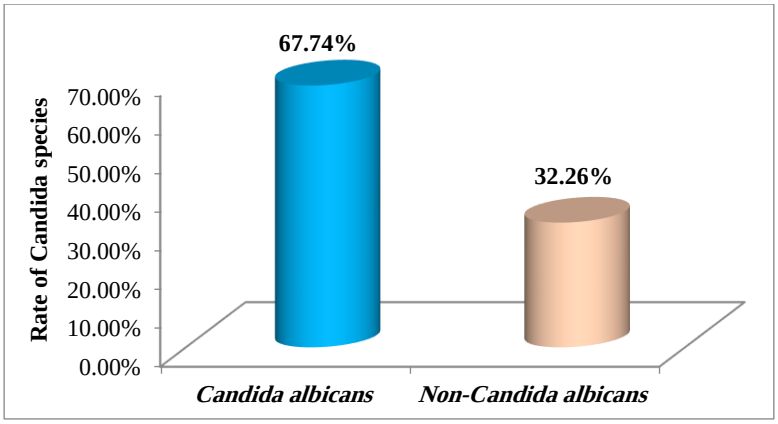


Figure 2: The rate of *Candida* species

Table 2: The frequency of *Candida* vaginitis infections according to age

Age group (in years)	Total tested	*C. albicans*	Non-*Candida albicans*	Total
	No. (%)	No. (%)	No. (%)	No. (%)
16-19	4 (9.09)	2(6.45)	0(0)	2(6.45)
20-24	13 (29.56)	8(25.81)	4(12.9)	12(38.71)
25-29	12(27.27)	5(16.13)	3(9.68)	8(25.81)
30-34	7(15.90)	3(9.68)	2(6.45)	5(16.13)
35-39	8(18.18)	3(9.68)	1(3.23)	4(12.9)
Total	**44(100)**	**21(67.74)**	**10(32.26)**	**31(100)**

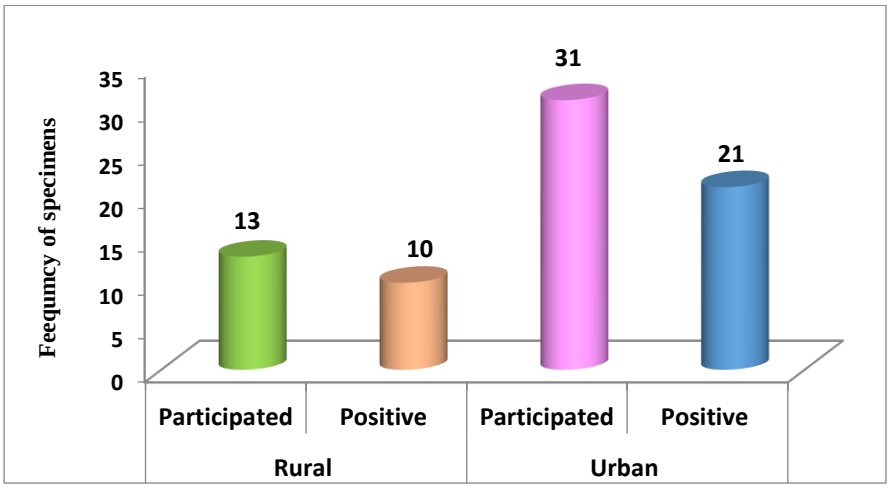


Figure 3: Frequency of candidiasis infection according to area

In the present study, women with secondary certificates were more affected than those patients with illiterate and primary school education. Similarly, vulvovaginal candidiasis was higher among the third trimester gestational age with 18(58.07%). Also, vulvovaginal candidiasis was higher slightly among paucipara mothers (51.61%) compared to multipara (47.39%) study subjects. The highest rate of vulvovaginal candidiasis was 83.87% recorded for recurrent infection. The higher rate of vulvovaginal candidiasis was 90.32% found among women administered antibiotics (Table 3).

Table 3: Distribution of vulvovaginal candidiasis in relation to risk factors

Variables		Total tested	*C. albicans*	Non-*Candida albicans*	Total
		No. (%)	No. (%)	No. (%)	No. (%)
Educational status	Illiterate	9(20.45)	5(16.13)	1(3.23)	6(19.35)
	Primary	7(15.91)	1(3.23)	5(16.13)	6(19.35)
	Secondary	16(36.37)	8(25.81)	3(9.68)	11(35.48)
	Graduate	12(27.27)	6(19.35)	2(6.45)	8(25.81)
Gestational trimester	First trimester	12(27.27)	3(9.68)	4(12.9)	7(22.58)
	Second trimester	11(25.0)	5(16.13)	1(3.23)	6(19.35)
	Third trimester	21(47.73)	12(38.71)	6(19.35)	18(58.07)
Parity	Paucipares (1-2 birth)	23(52.27)	9(29.03)	7(22.58)	16(51.61)
	Multipara (> 2 births)	21(47.73)	11(35.48)	4(12.9)	15(47.39)
Infection frequency	First time	7(15.91)	3(9.68)	2(6.45)	5(16.13)
	Recurrent	37(84.09)	17(54.84)	9(29.03)	26(83.87)
Uses of antibiotics	Yes	39(88.64)	18(58.06)	10(32.26)	28(90.32)
	No	5(11.36)	2(6.45)	1(3.23)	6(19.35)

The present study showed that the most clinical signs and symptoms among pregnant women with vaginitis were itching (70.97%) burning (67.74%), and discharge (61.29%) caused by *C. albicans* whereas all the participated patients were negative for diabetes mellitus as listed in the Table (4).

Table 4: Clinical signs and symptoms of participating in a study

Variables		Total tested	*Candida albicans*	Non-*Candida albicans*	Total
		No. (%)	No. (%)	No. (%)	No. (%)
Itching	Yes	42(95.45)	22(70.97)	9(29.03)	31(100)
	No	2(4.55)	0(0)	0(0)	0(0)
Burning	Yes	42(95.45)	21(67.74)	8(25.81)	29(93.55)
	No	2(4.55)	0(0)	2(6.45)	2(6.45)
Discharge	Yes	41(93.18)	19(61.29)	11(35.48)	30(96.77)
	No	3(6.82)	1(3.23)	0(0)	1(3.23)
Diabetes mellitus	Yes	0(0)	0(0)	0(0)	0(0)
	No	44(100)	21(67.74)	10(32.26)	31(100)

The antifungal susceptibility results revealed that between 90-100% of isolated *Candida* species were sensitive to fluconazole. Also, amphotericin B was an effective drug with a rate between 45.45-55% and followed by

nystatin between 36.36-66.67%. Whereas, Non-*Candida albicans* showed resistance to amphoteracin B (45.45%) and nystatin (33.33%) as shown in Table (5).

Table 5: Antifungal susceptibility profiles of isolated *Candida* sp.

Antifungals	*Candida* species	
	C. albicans	**Non-*Candida albicans***
Amphoteracin B		
Sensitive (%)	11 (55)	5(45.45)
Moderate (%)	3 (15)	1(9.1)
Resistant (%)	6 (30)	5 (45.45)
Fluconazole		
Sensitive (%)	18(90)	10(100)
Moderate (%)	**0(0)**	**0(0)**
Resistant (%)	2 (10)	**0(0)**
Nystatin		
Sensitive (%)	8(36.36)	6(66.67)
Moderate (%)	8(36.36)	**0**
Resistant (%)	6(27.28)	3(33.33)

Discussion

Vulvovaginal candidiasis is caused by the overgrowth of yeast in the mucosa membrane of the female genital tract and is frequently diagnosed as a daily practice of gynecologist[14,25]. In the present result, of 44 specimens examined in this study, it was found that 70.45% of specimens showed as positive growth for *Candida* sp. in the culture media whereas 29.55% of specimens were reported as negative growth. These negative culture cases maybe referred to as another causal of vaginitis. This result is slightly higher than the report by Edrees *et al.*[17] who found that the prevalence of VVC was 61.5% recorded among pregnant women in Ibb city, Yemen. In Egypt, Abbas *et al.*,[26] reported that 60.8% of examined women were infected by vulvovaginal candidiasis.

However, the lower rate of VVC among pregnant women was 51.6% found in Sana'a, Yemen, to according a study by Al-Rukeimi *et al*[19]. Another study by Abdul-Aziz *et al.*[18] recorded that the vaginal candidiasis among reproductive-aged women was 17.69%.

The incidence of VVC differs from one report to another according to health status. A study, in Lebanon, by Ghaddar *et al* [27] showed the 39% of examined pregnant woman was infected by *Candida* sp. The high rate of *Candida* sp. that found in the present study maybe refer to the factors such as socio-demographic characteristics, the status of patient immunity, use of the broad-spectrum antibiotics for treatment, and hormonal influences that contribute to influencing the prevalence of VVC among pregnant woman subjected to a study.

The result of this study was indicated that *C. albicans* 67.74% are responsible for the

greatest number of symptoms associated with vaginal candidosis. This finding is consistent with the several works reported by Edrees *et al.*[17] in Yemen, and Bitew and Abebaw[14] in Ethiopia and Nurat *et al.*,[28] in Nigeria.

This result is higher than reported by Al-Rukeimi *et al.*[19] in Sana'a and lower than study by Omar *et al.*,[29] in Egypt who found that the *C. albicans* was the highest (78.3%) isolated species from infected women by vaginitis.

During the last three decades were noticed that the increase in the rate of vaginitis caused by non-albicans species of *Candida*. The present study showed the increase in the frequency of non-albicans species as potential causes of vaginal candidiasis. The higher rate of non-*Candida albicans* was reported by Nurat *et al.*[28] and Al-Rukeimi *et al.*[19].

The highest frequency of *Candida* species infection in this study was most commonly seen among the 20-24 years age group and this result is in agreement with Al-Rukeimi *et al.*[19] in Sana'a who documented that the highest VVC was among the age group of 20-24 years,. Also, in a similar study carried out in Nigeria by Nurat *et al.*[28] who observed the age of 20-29 years old had the highest rate of candidiasis.

In a different study by Edrees *et al.*,[17] showed that the highest prevalence of *Candida* infection was 54.48% recorded in the group aged 28-37 years.

The highest distribution of vaginitis (76.92%) cases in the current study were found among women coming from the rural area compared to women from the urban (67.74%) area. This result in agreement with several reports that documented the higher rate of VVC among pregnant women living in rural area[17,18].

The high rate of communicable vaginitis among rural women frequently refers to poor situations of healthcare, absence of health education, lower-income, and difficulty in medical treatment in time[26]. However, the education status plays a significant role in contributing to the improvement of personal hygiene which lacks in the rural area and that may explain the variance in the frequency of infection between the urban area and rural area[14].

The highest rate of VVC in this work was 35.48% recorded among participated women who have secondary school certificate. This result is in disagreement with different reports that noticed the high rate of VVC was found the illiterate woman[14, 19]. Educational status plays an important role in increasing awareness about personal hygiene and reduces the transmission of disease.

However, the VVC was higher slightly among paucipara mothers compared to multipara mothers. Similarly, vulvovaginal candidiasis was higher among the third trimester gestational age with 18(58.07%). This result is similar to the report by Sangaré *et al.*,[30] different from results reported by Al-Rukeimi *et al.*[19]; who observed that pregnant woman with the first trimester had the rate of VVC.

The present study showed that the high frequency of isolated *Candida* was 83.87% reported among women with recurrent vulvovaginal candidiasis infection. These results in disagreement with Abruquah,[31].

This result revealed that the highest rate of VVC among pregnant women administered antibiotics. Vulvovaginal candidiasis frequently follows the use of vaginal or systemic antibiotics [32]. Antibiotics alter the normal flora of the vagina and thus allow overgrowth of *Candida* sp. After antibiotic use, the increase in vaginal colonization with *Candida* sp.,[33].

In the current study, the frequency of isolated *Candida* sp. among pregnant

women who complained of itching, burning, and discharge were 100%, 93%, and 93.55%, respectively, which was the highest percentage. This study similar to results by Falahati *et al.*,[34] who showed that the frequency of isolated *Candida* among women who complained of discharge was 82.1%, itching 62.7%, and burning 49.3%. However, it was observed that all participated women free from diabetes mellitus.

In the antifungal susceptibility results, it was reported that the highest sensitivity of antifungals against isolated *Candida* species was fluconazole, amphotericin B, and nystatin. In contrast, non-*Candida albicans* showed resistance to amphoteracin B (45.45%) and nystatin (33.33%). This finding is in agreement with the work of Bitew and Abebaw[14] and Edrees *et al.*,[17]. The most concern in Yemen is representing on the availability of antibiotics and easy to purchase from drug store without prescription by physician[35-37]. Therefore, antifungal susceptibility testing is very necessary to determine the effective antifungal for VVC among pregnant women without complications on both maternal and fetal health[38-40].

Study Limitations

The limitation of this study representing the use of conventional mycology techniques which depend on the phenotypic identification technique that is known to be insufficient to differentiate between *Candida* species. Therefore, the identification was limited to differentiate only between *Candida albicans* and non-*Candida albicans*.

Conclusion

In conclusion, vaginal infections are very common in our region and have a high frequency. It was found that *C. albicans* was the predominant isolated species from pregnant-woman. All isolates were susceptible to fluconazole and nystatin. This is the first report on the types of *Candida* sp., causing vaginal candidiasis and their antifungal susceptibility patterns in Ha Yemen.

Acknowledgment

The authors thank participating investigators; Hala Majmal, Samira Al-Nusairi, Ghaida Al-Mahbashi, Thakra Shoay, Amira Hermes, and Wejdan Al-Gharbani for their help in collecting the data and sampling of specimens. Also, they would like to thank the healthcare workers in the hospitals of Al-Gmohori hospital at Hajjah city for their generous help during this work.

References

1. Achkar JM, Fries BC. *Candida* infections of the genitourinary tract. Clin Microbial Rev. 2010; 253-273.
2. Eiderbrant K. Development of quantitative PCR methods for diagnosis of bacterial vaginosis and vaginal yeast infection. M.Sc. Thesis, Linkopings University, Linkoping, Sweden. 2010; 25-114.
3. Goncalves B, Ferreira C, Alves CT, Henriques M, Azeredo J, Silva S. Vulvovaginal candidiasis: epidemiology, microbiology and risk factors. Crit Rev Microbiol. 2016;42(6):905–927
4. Corsello S, Spinillo A, Osnengo G, Pena C, Guaschino S, Beltrame A. An epidemiological survey of vulvovaginal candidiasis in Italy. Eur J Obstet Gynecol Reprod Biol. 2003; 110:66-72.
5. Grigoriou O, Baka S, Makrakis E, Hassiakos D, Kapparos G, Kouskouni E. Prevalence of clinical vaginal candidiasis in a University Hospital and possible risk factors. Eur J Obstet Gynecol Reprod Biol. 2006; 126(1):121-125.
6. Das-Neves J, Pinto E, Teixeira B, Dias G, Rocha P, Cunha T. Local treatment of vulvovaginal candidosis: General and practical considerations. Drugs. 2008; 68

(13):1787-1802.
7. Eschenbach DA. Chronic vulvovaginal candidiasis. N Engl J Med. 2004; 351:851- 852.
8. Morreira D, Paula CR. Vulvovaginal candidiasis. Int J Gynaecol Obstet. 2006; 92: 266-267.
9. Deoruhkar SC, Saini S. Vulvovaginal candidiasis due to non-albicans *Candida*: Its species distribution and antifungal susceptibility profile. Int J Curr Microbial App Sci. 2013; 2(12): 323- 328.
10. Ben-Haroush A, Yogev Y, Kaplan B. The importance of diagnostic work-up in the management of candidal vulvovaginitis: A prospective study. Clin Exp Ob stet Gynecol. 2004; 31:113- 116.
11. Boselli F, Chiossi G, Garutti P, Matteelli A, Montagna MT, Spinillo A. Preliminary results of the Italian epidemiological study on vulvovaginitis. Minerva Ginecol. 2004; 56:149-153.
12. Babic M, Dukie M. *Candida albicans* and non-albicans species as etiological agent of vaginitis in pregnant and non-pregnant women. Bosn J Basic Med Sci. 2010; 10 (1):89-97.
13. Ameri S, Falahati M, Kordbache P, Zaini F, Rahimi P. Activities of fluconazole in combination with terbinafine against non-albicans *Candida* species isolated from the patients with recurrent vulvovaginal candidiasis in comparison with ciclopirox olamine. Hormozgan Med J. 2015; 18 (6): 516-521.
14. Bitew A, Abebaw Y. Vulvovaginal candidiasis: species distribution of *Candida* and their antifungal susceptibility pattern. BMC Women's Health. 2018; 18:94.
15. Richter SS, Galask RP, Messer SA, Hollis RJ, Diekema DJ, Pfaller MA. Antifungal susceptibilities of *Candida* species causing vulvovaginitis and epidemiology of recurrent cases. J Clin Microbiol. 2005; 43, 2155-2162.
16. AL-Haik WM, Al-Haddad AM. Bacterial vaginosis among pregnant women in Hadhramout-Yemen. Alandalus J Appl Sci. 2017; 7(16):23-33.
17. Edrees WH, Al-Asbahi AA, Al-Shehari WA, Qasem EA. Vulvovaginal candidiasis prevalence among pregnant women in different hospitals in Ibb, Yemen. Universal Journal of Pharmaceutical Research 2020; 5(4):1-5.
18. Abdul-Aziz Maha *et al*. Bacterial vaginosis, vulvovaginal candidiasis and trichomonal vaginitis among reproductive-aged women seeking primary healthcare in Sana'a city, Yemen. BMC Infectious Diseases. 2019; 19:879-889.
19. Al-Rukeimi ADA, *et al*. Prevalence and risk factors associated with vulvovaginal candidiasis during pregnancy in Sana'a, Yemen. Universal Journal of Pharmaceutical Research 2020; 5(3):1-5.
20. Narkwa W. Antifungal susceptibility of *Candida* species and *Cryptococcus neoformans* isolated from patients at the Komfo Anokye Teaching Hospital in Kwnasi. M.Sc. Thesis, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. 2010.
21. Lennox JA, Abbey SD, Udiba D, Mboto CI, Ikpoh IS, Akubuenyi FC. Prevalence of vaginitis and vaginosis among University of Calabar female students. J Public Health Epid. 2013; 5(4): 167-172.
22. Rohde B, Hartmann G, Haude D, Kessieler HG, Langen ML. Introducing mycology by examples. Presented by Schering Aktiengesellschaft. Hamburg. 1980; 35-98.
23. Isibor JO, Eghubare AE, Omoregie

R. Germ tube formation in *Candida albicans*. Shiraze Med J. 2005; 6 (1 and 2).
24. Clinical and Laboratory Standards Institute (CLSI). Performance Standards for Antimicrobial Disk Susceptibility Tests; Approved Standard. Eight editions. 2005; 58-116.
25. Rajkumar R, Radhakrishnan S, Seenivasan C, Kannan S. Culture and identification of *Candida albicans* from vaginal ulcer and separation of Enolase on SDS - PAGE. lnte J Bio. 2010; 2(1): 84-93.
26. Abbas AM, Shaaban OM, Badran SM, Shaltout AS, Nasr A, Abdullah SA. Risk factors and health hazards of vaginal infections in upper Egypt: A cross sectional study. Thai J Obstet Gynecol. 2016; 30: 50-6.
27. Ghaddar N, *et al*. Prevalence and antifungal susceptibility of *Candida albicans* causing vaginal discharge among pregnant women in Lebanon. BMC Infectious Diseases. 2020; 20:32.
28. Nurat A, Ola B, Olushola S,Mikhail T, Ayodej A. Detection and Epidemiology of Vulvovaginal Candidiasis among Asymptomatic Pregnant Women Attending a Tertiary Hospital in Ogbomoso, Nigeria. International Journal of Biomedical Research 2015; 6(07): 518-523.
29. Omar MS, Abbas AM, Moharram AM, Farhan MM, Hassanen IH. Does vaginal douching affect the type of candidal vulvovaginal infection?. Mydical Mycology. 2015; 53(8):817-827.
30. Sangaré I, *et al*. Prevalence of vulvovaginal candidiasis in pregnancy at three health centers in Burkina Faso. Journal De Mycologie Médicale (2017)
31. Abruquah HH. Prevalence and antifungal susceptibility of *Candida* species isolated from women attending Gynaecological clinic in Kumasi, Ghana. Ournal Sci Tech. 2012; 32 (2): 39-45.
32. Wilton L, Kollarova M, Heeley E, Shakir S, 2003. Relative risk of vaginal candidiasis after use of antibiotics compared with antidepressants in women: postmarketing surveillance data in England. Drug Saf, 26(8):589-597.
33. Pirotta MV, Gunn JM, Chondros P, 2003. "Not thrush again" womens experience of post-antibiotic vulvovaginitis. Med J Aust, 179(1):34-46.
34. Falahati M, Akhlaghi L, Abianeh M, Assadi M, Nami S, Fateh R. Prevalence of *Candida albicans* and *Trichomonas vaginalis* infections in Women. Life Science Journal. 2013; 10(5): 479 -484.
35. Edrees, H.W., Al-Awar S.M., 2020. Bacterial contamination of mobile phones of medical laboratory workers at Sana'a city, Yemen and their antimicrobial susceptibility. J.P.P.R.es. 8 (6): 591-599.
36. Al-Khawlany RS, Edrees WH, *et al*. Prevalence of methicillin-resistant *Staphylococcus aureus* and antibacterial susceptibility among patients with skin and soft tissue infection at Ibb City, Yemen. PSM Microbiol, 2021: 6(1): 1-11.
37. Al-Haik MW, Al-Haddad MA, Al-kaf GA, Edrees HW. Antimicrobial activities for hadhrami honey on growth of some pathogenic bacteria. UJPR, 2017: 2(6), 7-12.
38. Alhlale FM, Saleh HA, Alsweedi SK, Edrees HW. The inhibitory effect of *Euphorbia hirta* extracts against some wound bacteria isolated from Yemeni patients. Chronicles of Pharmaceutical Science. 2019; 3(2): 780-786.
39. Alhlale MF, Humaid A, Saleh AH, Alsweedi KS, Edrees WH. Effect of most common antibiotics against

bacteria isolated from surgical wounds in Aden Governorate hospitals, Yemen. UJPR, 2020; 5(1): 21-24.
40. Edrees HW, Anbar AA. Prevalence and antibacterial susceptibility of bacterial uropathogens isolated from pregnant women in Sana'a, Yemen. PSM Biol Res., 2020; 5(4): 157-165.