BIOSCIENCES BIOTECHNOLOGY RESEARCH ASIA, March 2023. Vol. **20**(1), p. 359-365

Assessment of Risk Factors for Developing Vulvovaginal Candidiasis Among Women at Various Age Groups

V.R. Irene[1]*, C.I. Sajeeth[1], V. Karthikeyan[1] and J. Sabitha [2]

[1]Department of Pharmacy Practice, Grace College of Pharmacy, Kodunthirapully, Palakkad, Kerala-678004. India.
[2]Gynecologist- obstetrician, Paalana institute of medical sciences, Palakkad, Kerala-678004, India.

http://dx.doi.org/10.13005/bbra/3095

(Received: 04 March 2023; accepted: 29 March 2023)

Vulvovaginal candidiasis (VVC) is the second most frequent vaginal infection in women and occurs as an opportunistic infection generally caused by Candida albicans.The objective of the research is to determine the risk factors for developing VVC in women of reproductive age, pregnancy, and postmenopausal age. A 6-month prospective study was carried out in pregnant women, post-menopausal women, and women of reproductive age. In MS Excel 2007, the obtained cases were entered, and descriptive statistics were utilized to calculate the percentage of various parameters.The research consisted of a total of 90 individuals, whose participants ranged in age from 18 to 65. VVC was more common (40%) among females there in the reproductive ages of 18 to 35 (86.7%) of the 90 patients who don't follow regular exercise and 54.4 % have a BMI range (of 25-29.9) Overweight. Obesity, past medical and medication history such as Diabetes mellitus (27.7%), and antibiotic usage (23.3%) were major risk factors for acquiring VVC. Co-morbidities like diabetic mellitus, hypothyroidism, urinary tract infections, obesity, as well as PCOD are the main risk factors to cause VVC. Antibiotic usage in the past, the consumption of steroids, and an absence of regular exercise all contribute to the emergence of VVC.

Keywords: Candida albicans; Prevalence; Risk factors of VVC; Vulvovaginal Candidiasis (VVC).

The symptoms of vulvovaginal candidiasis(VVC), which would be brought on by an overgrowth of Candida species in the vagina, include itching, irritation, and curd-like vaginal discharge[1]. In healthy, asymptomatic women, the lower tract flora comprises 20–50% Candida albicans. Vulvovaginal candidiasis (VVC) is characterized as a disease with inflammation-related symptoms and signs and a variety of causes [2]. 75% of women encounter at least one episode of VVC during their lifetime. Though it's reported about 5% of women experience vulvovaginal candidiasis [2]. The main symptoms are itchiness and burning, along with discomfort, irritation, dyspareunia, & dysuria. Other common symptoms include fissures, vulval and vaginal erythema, increased vaginal discharge, and edema [2]. Vulvovaginal candidiasis is usually classified as either sporadic or recurrent on the basis of episodic frequency. It is clinically imperative to distinguish between sporadic and recurrent infections not only to understand the pathogenesis of each but also to

*Corresponding author E-mail: irenevadakkan@gmail.com

formulate specific diseasemanagement strategies[21]. The major risk factors for developing VVC are like oral contraceptive use, hormonal replacement therapy. It creates an estrogen-rich condition , which stimulates fungal growth and reproduction as well as vaginal colonization [3]. So far, vigorous mucosal inflammation that is primarily brought on by fungal overgrowth in the vagina and followed by epithelial invasion and the synthesis of virulence effectors can result in symptomatic infection[24].Other risk factors, like as genetic factors that influence the host's susceptibility to infection, inflammatory response development, vaginal microbiota dysbiosis, sexual activity, personal hygiene, and dressing pattern, as well as an illness like diabetes mellitus, can contribute to the development of VVC in addition to an environment that is high in estrogen [3]. The vaginal microbiome (VMB), which is influenced by both internal and external variables like menstruation, intestinal microbiota (near the rectum), and personal contact, is crucial for preventing the colonization of infections. The diseased condition like Diabetes mellitus(DM) which creates favourable environment for candida overgrowth, the presence of sugar also stimulate the Vulvovaginal candidiasis. The main reasons for this colonization seem to be altered functions of the immune system in diabetic patients with poor glycemic control or a direct effect of elevated blood glucose levels, creating specific conditions for intensive fungal colonization[17].In order to reduce the risk of VVC; proper vaginal hygiene should be maintained. Avoid unnecessary usage of antibiotics, oral contraceptives etc. Use loose fitting undergarments; to reduce the chance of friction and moisture retain in vaginal area. Maintain a proper healthy diet to improve the vaginal health. Vagina's acidity, bringing it down to pH 5.0-6.5, allowing pathogenic organisms like Candida to flourish.Age, menstrual cycle phase, sexual activity, choice of contraception, pregnancy, the presence of necrotic tissue or foreign substances, and the use of hygiene products or antibiotics can all cause a rise in vaginal Ph[27].

MATERIALS AND METHOD

Study design: Prospective study

Study site: Paalana Institute of Medical Sciences Palakkad, a multi super- specialty hospital that is well equipped and has a capacity of more than 250 beds.

Sample size: n= 90

Study period: July 2022 to December 2022 (6 months).

The study was approved by Institutional Ethics Committee GCP/IEC/112C/2022 dated 05-07-2022.

Inclusion Criteria

Female patients in age 18-65 years diagnosed with VVC and also willing to give consent for the study.

Exclusion Criteria

Patients with STD, pelvic inflammatory disease, fibroids, endometriosis, serious health problems like liver failure, renal failure, and heart disease, and Vulvar dermatoses like lichen sclerosis.

Data collection

The study was explained to patients and written informed consent was taken from patients. The study population is then categorized into women of reproductive age, pregnancy, and post-menopausal age. Investigation of Risk Factors is done by using the data collection form, it includes the general required information such as age, body weight, BMI, occupation, and educational level; daily living habits such as the frequency of drinking sweet drinks and eating sweet foods, the frequency of exercise, and daily emotional state; hygienic habits such as menstrual care, underwear material and the previous history of any contraceptive methods, reproductive histories such as marriage state, history of vaginitis, and history of abortion; sexual behaviors, etc. This study aims to estimate the risk factors for developing VVC among women at reproductive age, pregnancy, and post-menopausal age.

Statistical analysis

The collected cases were entered in MS Excel 2007 for calculating the percentage of various parameters. Descriptive statistics like frequency and percentage, standard deviation were used to describe the demographic characteristics and determinants of VVC.

RESULTS

A total of 90 patients were included in this study. Among the collected data, VVC was more

prevalent among women in the reproductive age group 18-35 (40%), in the pregnancy age group 20-29(13.3%), and in post-menopausal age group 60-65 (12.2%) (Table -1).VVC is more common among married women [88 patients] (97%) and only 3% [2 patients] having VVC among un-married women (Figure-1).Prevalence of VVC is higher in women's with BMI ranging between 25-29.9 (54.4%),which indicates overweight is the main reason for developing VVC; BMI range <18.5(2.2%), BMI range between 18.5- 24.9 (54.4%), BMI range >30 (7.8%) (Table-2).

Among the study population (n=90), 86.7% of the patients have lack of regular exercise and 13.3% of the patient with regular exercise (Figure-2).

Past medical history like Diabetes mellitus (27.7%), hypothyroidism (27.7%), Urinary tract infection (20%), obesity (14.5%), PCOD (7.7%), anemia (3.4%) Others (27.8%) and past medication history like administration of antibiotics (23.3%), steroids & oral contraceptives (1.1%) were the major risk factors for VVC (Table -3)

DISCUSSION

The symptoms of vulvovaginal candidiasis, which is brought by an overgrowth

Table 1. Prevalence Distribution Of Women Based On Age Category (N=90)

Age category	Age range	Mean value of age ± SD	No. of patients (n= 90)	Percentage (%)
Reproductive age	18-35	29 ± 4.5	36	40 %
	36-49	43± 3.4	19	21.1%
Pregnancy	20-29	26± 1.30	12	13.3%
	30-49	34± 4.94	2	2.2%
Post menopausal age	50-55	52± 1.71	10	11.1%
	56-65	60± 3.62	11	12.2%

Table 2. Distribution Based On BMI

Sl. No.	BMI (Kg/m^2)	Mean Value ±SD	No. of patients(n=90)	Percentage (%)
1	<18.5(Underweight)	14.2 ±0.77	2	2.22%
2	18.5-24.9(Normal)	22.8 ±1.58	31	34.4
3	25-29.9(Overweight)	27.4± 1.21	49	54.4%
4	>30(Obesity)	32.2± 2.16	7	7.8%

Table 3. Distribution Based On Past Medical And Medication History

Past medical history	No. of patients (n= 90)	(%)	Past medication history	No. of patients (n= 90)	(%)
No past medical history	19	21.1	No past medication history	65	72.3
Diabetes mellitus	25	27.7	Antibiotics	20	22.3
Hypothyroidism	22	24.5	Oral contraceptives	1	1.1
UTI	18	20	Steroids	1	1.1
Obesity	13	14.5	HRT	1	1.1
PCOD	7	7.7			
Anemia	3	3.4			
Others	25	27.8			

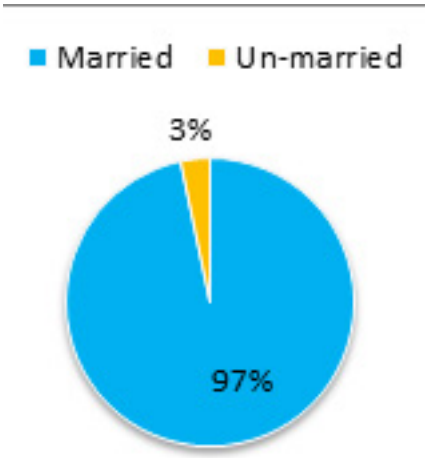

Fig. 1. Distribution Based On Marital Status

of Candida species in the vagina, include itching, erythema, and curd-like vaginal discharge[1]. In healthful, asymptomatic women, the lower tract microbiota comprises 20–50% Candida albicans. Under this study, VVC is more prevalent in 40% of women between the age of 18 and 35 who are sexually active (Table: 1). Women under 40 had twice as high a risk of getting VVC as those over 40, according to previous research[5]. The Studies have reported the prevalence of VVC as 25%, 24%, and 18.5% [7, 8, & 9] (2015). The age group of 26 to 30 years had the greatest percentage of VVC (39.08%), followed by the age group of 31 years, based on a study by Dr. Meena Salvi *et al* (2019*)*. The majority of women were sexually active

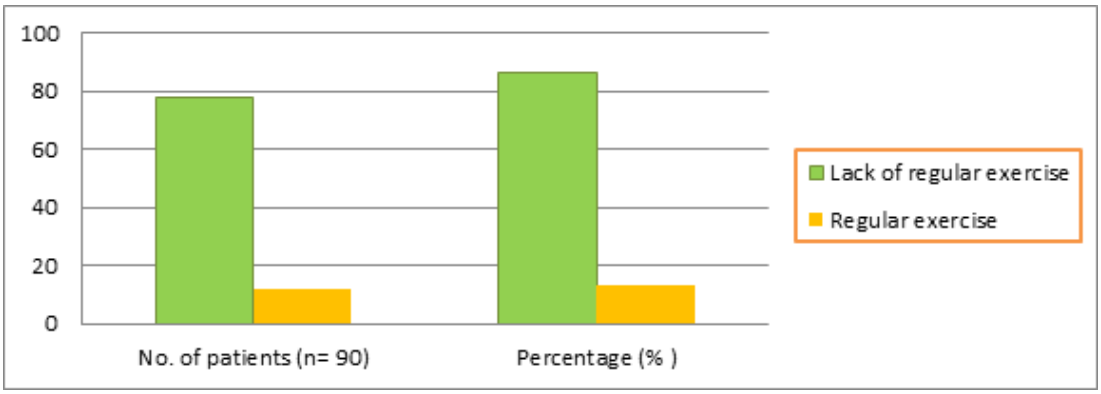

Fig. 2. Distribution Based On Daily Exercise

during the reproductive years, and their bodies also produced more estrogen at this time. Women in this age group tend to have multiple children and frequently utilize contraception, which is beneficial for candidiasis [10]. Young women may be more susceptible to negative influences including unsafe sexual practices, which may account for the higher prevalence of VVC in this population [5]. Additionally, during this period of life, women experience physiological and tissue changes brought on by reproductive hormones that make them more vulnerable to Candida infection [5]. The results indicate that married women (96.7%) had a higher incidence of candidiasis than single women (Figure: 1). The prevalence of candidiasis is estimated to be 18 (28% of married women) and 10 (20%) in Iyevhobu Kenneth oshiokhayamhe *et al* studies[11]. Differences in the vaginal environment and sexual practices cause VVC in married women.

This study found that VVC is more common in women with higher BMI levels (overweight). Prevalence of VVC is higher in women's with BMI ranging between 25-29.9 (54.4%),which indicates overweight is the main reason for developing VVC (Table:2). Obesity is a low-grade inflammatory condition, and adipose tissue is an immunological organ that is active and produces higher tumor necrosis factor (TNF), interleukin (IL)-1, and IL-6. Obesity is associated with an increase in infection susceptibility [12]. Gary Ventolini *et al*., demonstrated in their research that obesity can be an independent risk factor for VVC in women of reproductive age through the mechanism of altered vaginal immunity [12]. Obese people may retain moisture in their body folds, which can encourage the development of candida overgrowth. 86.7% of the 90 participants in this research don't exercise regularly. Previous research has focused on the

effects of regular exercise, a sedentary lifestyle, and regular emotional states. In the end, regular exercise and positive feelings protected the VVC [5]. Regular exercise helps keep a healthy weight while enhancing immunity to several diseases. When it pertains to their eating habits, 96.7% of people follow a mixed diet, while 11.2% frequently consume sweet foods. A body with more sugar promotes a glycogen environment that is suitable for Candida species, and regular intake of sweet foods boosts the chance that diabetes will develop. This may be a factor as far as how Candida can adhere to vaginal epithelial cells and continue to develop as a result of the enhanced glucose concentrations in vaginal secretions [5].Several risk factors contribute to vulvovaginal candidiasis. The following physiologic alterations that take place during pregnancy increase the risk of VVC: decreased cellular immunity, raised hormone levels, reduced vaginal pH, and elevated vaginal glycogen content [13]. A few other personal hygiene, dressing, and sexual practices are also risk factors, also with hyperestrogenism, hormonal imbalance, immunological suppression during disease or psycho-emotional stress, hyperglycemia, vaginal dysbacteriosis, IUDs, spermicidal, condoms, hyperglycemia[14]. One of the major reasons for VVC, among many others, is hormonal imbalance. It was once hypothesized that the hormones estrogen and progesterone might be used in contraceptives to increase vaginal glycogen and make them more susceptible to the action of *lactobacilli*. Most experts agree that *lactobacilli* have a role in the conversion of glycogen into lactic, which reduces the pH of the vagina. The lower pH inhibits the activity of the bacterial biota, which encourages the development of yeast, particularly *Candida* species [15].Pregnancy frequently results in vaginal candidiasis, which is caused by a change in pH and sugar levels. Increases in estrogen in pregnancy lead the vagina to generate more glycogen, which has a direct impact on yeast cells by increasing their multiplication and causing them to adhere to the vaginal walls [16]. As the high estrogen levels increase the glycogen content in vaginal secretion, the incidence of VVC increases without any negative consequences during the pregnancy [31]. Vulvo vaginal candidiasis is an important cause of morbidity inpregnancy which can result in miscarriages, candida chorioamnionitis, subsequent preterm delivery and emotional stress[30]. The hormonal balance in the vaginal microbiota is changed as a result of previous medical history, including the use of contraception tablets or any other method of contraception. The next major risk factor is the overuse of antibiotics. In this research, 22.3% of the participants had previously taken antibiotics. A barrier against infection, colonization resistance, and *Candida* germination are provided by the usual protective vaginal bacterial flora[6]. Wearing tight undergarments and the type of underwear used, in addition to these and other factors, enhance VVC. Synthetic underwear does seem to cause increased friction and maceration, which increases the local acidity and encourages the growth of fungi. Undergarments made from cotton and clothes with proper ventilation may help prevent infection [17]. This study examined the consequences of past medical conditions such as obesity, PCOD, hypothyroidism, urinary tract infections, and diabetes mellitus. A history of DM (about 27.7%), hypothyroidism (about 24.5%), UTI (about 20%), and obesity (about 14.4%) were among the participants. A lot of earlier studies have already examined the connection between DM and VVC. Hyperglycemia is the major factor enhancing diabetic individuals' susceptibility to vulvovaginal candidiasis. Yeast grows and adheres to vaginal tissues as blood sugar levels rise. Vascular epithelial cells adhere to Candida albicans more frequently in people with diabetes [18]. Sugar in the urine accelerates the spread of the infection. Hypothyroid patients are less likely to build immunity and have lower body temperature;it favors *candida* over growth. The assessment of local safety and allergic reactions in the vaginal environment has been a key component of certain research on the association between a patient's immunity and the incidence of VVC [19].VVC development seems to be more likely when pantyliners and material underwear are synthetic. Pantyliners may retain heat and moisture, which could promote the growth of VVC or microorganisms[20]. For epidemiologic characterization and effective infection therapy, the etiological agent must be correctly identified. Therefore, more precise techniques are needed to choose a therapeutic course of action and to reduce patient risks, such as molecular techniques and antifungal susceptibility tests for Candida spp[28].

CONCLUSION

The study concluded about the possible risk factors to cause Vulvovaginal candidiasis (VVC). VVC was more prevalent in women in the reproductive age range due to their hormonal influences, sexual behavior, personal hygiene, and other variables. Sexual practices and personal hygiene have a significant impact on vaginal infection. Obesity; lack of regular exercise and past medication histories, such as the use of antibiotics, and past medical history, such as diabetes mellitus (DM), were significant reasons to cause VVC.

ACKNOWLEDGEMENT

I would like to express our sincere thanks to all the medical and non-medical staffs and patients of Paalana Institute of Medical Sciences; Palakkad, Kerala.

Conflicts of Interest:

No conflicts of interests declared by the authors

Funding Sources

The study was approved by Institutional Ethics Committee GCP/IEC/112C/2022 dated 05-07-2022.

REFERENCES

1. Gulnar K, Multani H. Study of vulvovaginal candidiasis in symptomatic women of reproductive age group attending tertiary care institute, Haryana province. Asian Journal of Medical Sciences. 2021; 12(2):66-70.
2. Siddiqui R. Clinical patterns and risk factors of vulvo-vaginal candidiasis among women of reproductive age attending a tertiary hospital in central India. Stamford Journal of Microbiology. 2019; 9(1):27-31.
3. Pereira LC, Correia AF, da Silva ZD, de Resende CN, Brandão F, Almeida RM, de Medeiros Nóbrega YK. Vulvovaginal candidiasis and current perspectives: new risk factors and laboratory diagnosis by using MALDI TOF for identifying species in primary infection and recurrence. European Journal of Clinical Microbiology & Infectious Diseases. 2021; 40(8):1681-93.
4. Dahal P, Jhendi S, Pun CM, Maharjan L. Assessment of risk factors and medication use for infectious vaginitis among females of reproductive age visiting maternity hospital of Pokhara, Nepal. The Open Public Health Journal; 10(1).2017.
5. Zeng X, Zhang Y, Zhang T, Xue Y, Xu H, An R. Risk factors of vulvovaginal candidiasis among women of reproductive age in Xi'an: a cross-sectional study. BioMed research international. 2018.
6. Mtibaa L, Fakhfakh N, Kallel A, Belhadj S, Salah NB, Bada N, Kallel K. Vulvovaginal candidiasis: Etiology, symptomatology and risk factors. Journal de mycologie medicale. 2017; 27(2):153-8.
7. Kwawukume EY, ArhinRA. Vulvovaginitis. In: Kwawukume EY, Emuveyan EE, eds. Comprehensive Gynaecology in the Tropics. 1sted. Dansoman: Asante and Hittscher Printing Press Limited; 2002:72-74.
8. Sasani E, Rafat Z, Ashrafi K, Salimi Y, Zandi M, Soltani S, Hashemi F, Hashemi SJ. Vulvovaginal candidiasis in Iran: A systematic review and meta-analysis on the epidemiology, clinical manifestations, demographic characteristics, risk factors, etiologic agents and laboratory diagnosis. Microbial pathogenesis. 2021;154:104802.
9. Venugopal D, Husain K, Mustafa SA, Sabeen S. Epidemiology, risk factors and antimicrobial profile of Vulvovaginal Candidiasis (VVC): A study among women in the central region of Saudi Arabia. Journal of Medical Mycology. 2021;31(2):101049.
10. Salvi M. Prevalence of vulvovaginal candidiasis in females in the reproductive age group. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2019 1; 8(2):647-52.
11. Iyevhobu KO, Airefetalor AI, Turay AA, Usoro ER, Ken-Iyevhobu BA. Assessment of the Incidence of Candidiasis among Single and Married Women; 2021.
12. Ventolini G, Khandelwal N, Hutton K, Lugo J, Gygax SE, Schlabritz-Loutsevitch N. Obesity and recurrent vulvovaginal bacterial infections in women of reproductive age. Postgraduate Medical Journal. 2017.1; 93(1099):297
13. Ghaddar N, El Roz A, Ghssein G, Ibrahim JN. Emergence of vulvovaginal candidiasis among Lebanese pregnant women: prevalence, risk factors, and species distribution. Infectious diseases in obstetrics and gynecology. ; 2019; 180-91.
14. Konadu DG, Owusu-Ofori A, Yidana Z, Boadu F, Iddrisu LF, Adu-Gyasi D, Dosoo D, Awuley RL, Owusu-Agyei S, Asante KP. Prevalence of vulvovaginal candidiasis, bacterial vaginosis and trichomoniasis in pregnant women attending antenatal clinic in the middle belt of Ghana. BMC

pregnancy and childbirth. 2019(1):1-0. Enweani IB, Gugnani HC, Okobia R, Ojo SB. 2001, Effect of contraceptives on the prevalence of vaginal colonization with Candida species in Edo State, Nigeria. Rev Iberoam Micol. 18: 171-173.

15. Parveen N, Munir AA, Din I, Majeed R. 2008, Frequency of vaginal Candidiasis in pregnant women attending routine antenatal clinic J Coll Physicians Surg Pak.18(3):154.
16. Becker M, Sobel R. Vulvovaginal Candidiasis in Postmenopausal Women. Current Infectious Disease Reports. 2023:1-6.
17. Rodrigues CF, Rodrigues ME, Henriques M. Candida sp. infections in patients with diabetes mellitus. Journal of clinical medicine. 2019; 8(1):76.
18. Talaei Z, Sheikhbahaei S, Ostadi V, Hakemi MG, Meidani M, Naghshineh E, Yaran M, Naeini AE, Sherkat R. Recurrent vulvovaginal candidiasis: could it be related to cell-mediated immunity defect in response to Candida antigen?. International Journal of Fertility & Sterility. 2017; 11(3):134.
19. Farage M, Bramante M, Otaka Y, Sobel J. Do panty liners promote vulvovaginal candidiasis or urinary tract infections? A review of the scientific evidence. European Journal of Obstetrics & Gynecology and Reproductive Biology. 2007; 132(1):8-19.
20. Rad MM, Zafarghandi S, Abbasabadi B, Tavallaee M. The epidemiology of Candida species associated with vulvovaginal candidiasis in an Iranian patient population. European Journal of Obstetrics & Gynecology and Reproductive Biology. 2011;155(2):199-203.
21. Sobel JD, Faro S, Force RW, Foxman B, Ledger WJ, Nyirjesy PR, Reed BD, Summers PR. Vulvovaginal candidiasis: epidemiologic, diagnostic, and therapeutic considerations. American journal of obstetrics and gynecology. 1998;178(2):203-11.
22. Cianci A, Cicinelli E, Colacurci N, De Leo V, Perino A, Pino A, Bartolo E, Randazzo CL, Esposito G, Chiaffarino F, Parazzini F. Diagnosis and treatment of vulvovaginal candidiasis: A practical approach. Italian Journal of Gynaecology and Obstetrics. 2020;32(4):261-8.
23. Monif GR. Classification and pathogenesis of vulvovaginal candidiasis. American journal of obstetrics and gynecology. 1985 Aug 1; 152(7):935-9.
24. Willems HM, Ahmed SS, Liu J, Xu Z, Peters BM. Vulvovaginal candidiasis: A current understanding and burning questions. J Fungi (Basel). 2020; 6 (1): 27.
25. White DJ, Vanthuyne A. Vulvovaginal candidiasis. Sexually transmitted infections. 2006; 82(suppl 4):iv28-30.
26. Disha TL. Prevalence and Risk factors of Vulvovaginal Candidiasis during pregnancy: A Review (Doctoral dissertation, Brac University).
27. Okonkwo NJ, Umeanaeto PU. Prevalence of vaginal candidiasis among pregnant women in Nnewi Town of Anambra State, Nigeria. African research review.2010;4(4).
28. Brandão LD, Boniek D, Resende Stoianoff MA, da Mata FM, de Azevedo PR, Fernandes JV, Andrade VS. Prevalence and antifungal susceptibility of Candida species among pregnant women attending a school maternity at Natal, Brazil. Letters in applied microbiology. 2018; 67(3):285-91.
29. Mathur S, Mathur RS, Dowda H, Williamson HO, Faulk WP, Fudenberg HH. Sex steroid hormones and antibodies to Candida albicans. Clinical and Experimental Immunology. 1978; 33(1):79.
30. Sony P, Iyanar K. Prevalence of antenatal vulvovaginal candidiasis: our experience. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2017;6(2):443-7.
31. Bender RA, Çalýþkan Þ, Önal B, Aslancan R, Çalýþkan E. Treatment methods for vulvovaginal candidiasis in pregnancy. Journal of Medical Mycology. 2021;31(3):101138.