Prevalence and Risk Factors Associated with Bacterial Vaginosis and Candidiasis in Non-Pregnant Women of Western Odisha, India

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ABSTRACT

BACKGROUND

The prevalence of Bacterial Vaginosis (BV) and candidiasis is high in Indian women in the reproductive age groups. Poor menstrual hygiene management (MHM) practices and low socio-demographic features are the major risk factors associated with BV and candidiasis. The aim of the study was to access the MHM practices in association with BV and *Candida* infection in the population of western Odisha.

METHODS

This cross-sectional study was carried out in the outpatient department of O & G, VIMSAR, Burla, Odisha, from December 2016 to November 2018. Vaginal swabs were collected from the posterior vaginal fornix for analysis. BV was diagnosed by using Nugent's laboratory diagnostic criteria and identification of *Candida* was done by Albi Quick™ rapid test. A pre-coded questionnaire was used to collect demographic, clinical, and behavioural (MHM practices) features from the study participants. All data were double-entered into Epi Info 7 software and analysed using Stata 11.0.

RESULTS

In 352 women, the prevalence of BV and candidiasis was found in 38.92% (137/352) and 32.67% (115/352) of women respectively. Women were divided into three groups on the basis of age i.e. 18-25 years: 87 (24.72%); 26-35 years: 194 (55.11%); and 36-45 years: 71 (20.17%). Both BV and candidiasis were significantly high in women of 36-45 years age group compared to 18-25 years age group ($p < 0.05$). Women of 36-45 years age group had more number of cases with low education (19.72%), housewife (67.61%), and living in rural villages (61.97%) compared to younger women ($p < 0.05$). Regarding MHM practices, women in the higher age groups used more reusable cloths as absorbent materials ($p < 0.002$), changed absorbent material less frequently ($p = 0.042$) and changed their absorbents somewhere other than in a toilet facility ($p < 0.018$) compared to younger women.

CONCLUSIONS

The higher prevalence of BV and candidiasis in higher age groups of women may be due to the poor MHM practices, lack of higher education and other low socio-demographic conditions compared to younger age women. An increased awareness for MHM practices is important to combat the associated morbidities related to BV and candidiasis.

KEY WORDS

Bacterial Vaginosis, Candidiasis, Menstrual Hygiene Management Practices, Age, Odisha

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BACKGROUND

Bacterial vaginosis (BV) and vulvovaginal candidiasis are the major urinary tract infections in women worldwide. According to the Centers for Disease Control and Prevention, BV is the most common vaginal infection in women in the reproductive age (15-44 years of age).¹ BV is a condition characterized by shifting of vaginal microbial flora from a predominant population of *Lactobacilli* to anaerobic microorganisms such as *Gardnerella vaginalis*, *Prevotella*, *Bacteroides* and *Mobiluncus* species, and with other bacteria including *Mycoplasma* and *Ureaplasma* species.² Women with BV usually have a dense biofilm which consisting of a matrix of polysaccharides, proteins, extracellular DNA and embedded bacteria that tightly attached to the surface of vaginal epithelial cells. *Gardnerella vaginalis* alone represents around 80% of the total microbial species present in the biofilm.³⁻⁴ Women with BV usually have various symptoms of mucosal inflammation including, abnormal vaginal discharge, itching and burning, redness and swelling, dysuria, dyspareunia, pain etc.⁵ The characterization of BV can be done by various aspects such as epidemiological, microscopic, bacterial culture, molecular diagnosis methods. However all these methods have failed to reveal a common aetiology which can be consistently documented in all women with BV.⁵ Candidiasis is an infection caused by *Candida* species such as *Candida albicans* that affects millions of women every year.⁶⁻⁷ The signs and symptoms for candidiasis is thick and white vaginal discharge, redness and swelling of vaginal opening, pain, soreness and itching of vulva etc.

Globally, the prevalence of BV ranges from 8 to 51% and found to be varied with geographical location, socio-economic status and ethnicity of the women.⁸ Similarly, around 75% of women may experience candidiasis during their lifetimes world-wide.⁹ Many factors have been found to be associated with occurrence of BV and/or candidiasis including socio-demographic features such as age of the women, socio-economic status, residency and education, sexual relationship, douching, menstrual hygiene practices and, water accessibility and sanitation etc. Younger women in the reproductive age have been found to be associated with BV in a number of studies. In contrast, women also experienced with a high BV in their 4th and 5th decades of life.¹⁰⁻¹² In India, there are only few studies on the causes of BV and *Candida* infection in the women of reproductive age including the state of Odisha.¹³⁻¹⁸ Most of these studies have found a poor menstrual hygiene practices with low education and low socio-economic status behind both BV and *Candida* infection.

The poor menstrual hygiene practices include use of reuse clothes for absorbent materials instead of sanitary pads, frequency of changing of absorbent materials, change of absorbent materials outside the toilet facilities, washing and storage of reusable absorbent materials, wash variables etc. Further, there is a paucity of literatures on the prevalence of BV and *Candida* infection in the population with predominates of tribal communities. Studies on tribal population are important because of their traditional menstrual hygiene practices and socio-demographic determinants. This study was undertaken with an aim to access the menstrual hygiene management practices in

association with BV and *Candida* infection in the population of western Odisha.

METHODS

This was a cross-sectional study that surveyed women attending to the out-patient department (OPD) of Department of Obstetrics and Gynaecology (O&G) of Veer Surendra Sai Institute of Medical Sciences and Research (VIMSAR), Burla, Odisha, India. It is a tertiary care referral hospital for 12 million people residing in western Odisha and the state of Chhattisgarh. The hospital caters to both urban as well as rural area. In this institution, almost all the health care services are provided free of cost, hence the majority of the study participants attending this hospital were from the financially disadvantaged groups. The patient recruitment was done from December 2016 to November 2018. The study was approved by Institutional Ethical Committee of Veer Surendra Sai Institute of Medical Sciences and Research (VIMSAR), Burla, Odisha (IEC/IRB-14/16).

Study Population

Non-pregnant women of reproductive age between 18–45 years, attending the O & G outpatient department with vaginal symptoms such as abnormal vaginal discharge, itching, burning, dyspareunia, with lower abdominal pain, lower back pain were eligible for enrolment into the study. We excluded women who: were pregnant, menopausal women, were already undergoing treatment, were menstruating during the clinic visit, had had a hysterectomy, had taken a course of antibiotics during the previous three weeks, had used oral contraceptive pills in the previous three months, had diabetes mellitus, were HIV positive, or had any severe medical disorders requiring immediate referral to a higher level of health care. Considering the average prevalence of BV and candidiasis of 35% in Indian population with 95% confidence level and 5% error, the sample size was calculated as 350.

Data Collection

After identification by the treating doctor, all potential study participants underwent an informed consent process in local language and provided written consent if they wanted to participate in the study. The participants were informed that they would be tested for reproductive tract infection. A pre-designed questionnaire was asked to each woman. The questionnaire contains the information on socio-demographic factors (include age, marital status, religion, education, occupation, number of family member and monthly income), MHM practices and water and sanitation conditions in their household and clinical manifestations. Information on MHM practices included the type of menstrual absorbent used and individual hygiene habits. Questions on the use of absorbents materials included: the type of absorbent (reusable/disposable), the type of material used in reusable absorbents, frequency and place of change absorbent. In the case of reusable absorbents, information on the method of washing, drying, packaging, and storing were also asked. Information on water and sanitation conditions in their households, include information about access to latrine

and place where the main water source is located. Clinical symptoms related to vaginal discharge included its quantity, smell, colour, and consistency, burning or itching of the genitalia, and the presence of ulcers at vulva and labia, vesicles, papules.

Collection of Vaginal Samples

A speculum examination of vagina and cervix was done by a trained O & G specialist, particularly to look for the presence of cervical erythema, bleeding, inflammation, with or without discharge, and ulcers at cervix. Vaginal specimens from posterior vaginal fornix were collected using two BD BBL swabs (BD, Maryland, USA). The first swab was used for Gram staining to diagnose BV and the second swab was used to determine the presence of *Candida*. After labelling, all materials (slides and swabs) were preserved in the laboratory for subsequent diagnosis.

Diagnosis of BV and *Candida* Infection

BV was diagnosed using Nugent's laboratory diagnostic criteria.¹⁹ In brief, slides prepared from the vaginal swabs were stained with Gram's stain and examined for specific bacterial morphotypes.¹⁹ A Nugent score (NS) between 0-10 was generated using the Nugent criteria. A NS of 0 to 3 was interpreted as normal or negative for BV, a score of 4 to 10 as intermediate/abnormal for BV or positive for BV. Albi Quick™ rapid test (HARDY Diagnostic, CA, USA) was used for identification of *Candida albicans* as per manufacturer's instructions. Briefly, the vaginal swab was cultured in Blood Agar and Chocolate Agar plate for 48 hr at 37°C. After 48 hr, a sample was taken in a sterile loop and smeared on the test card for 5 min at room temperature. A bright blue-white or blue-purple fluorescence was observed for positive *Candida*

albicans infection and no fluorescence was seen for negative samples. During the study period, 1014 women who visited the gynaecology OPD of the hospitals, 352 reproductive age women were enrolled in the study, 74 did not consent to participate and a further 588 were excluded according to our criteria (figure 1).

Statistical Analysis

Generated data was entered into Epi Info 7 software. Data were presented in number followed by percentage. Chi square test was performed for comparison of categorical data among the groups, A p value of <0.05 was considered for statistically significant. All the statistical analysis was performed by using Stata 11.0 (StataCorp, Stata Statistical Software: Release 11. 2011, StataCorp LP: College Station, TX).

RESULTS

All the 352 women were categorised into 3 age groups i.e. 18-25 years, 26-35 years and 36-45 years. There were 24.72% (n=87), 55.11% (n=194) and 20.17% (n=71) non-pregnant women present in each age group. All women were married in each age group except 19.54% single women were there in the age group 18-25 years ($p < 0.001$). Though most women belong to Hindu religion but no statistical difference was found ($p < 0.362$). Majority of women had attained 12th grade or higher education and the difference was statistically significant ($p < 0.002$). While monthly income didn't show any statistical significance ($p < 0.052$), the primary occupation of the participants was housewife and showed statistical significance ($p < 0.039$) between three different age groups,

however 16.49% women in 26-35 age group were employed compared to 8.05% in 18-25 age group and 4.23% in 36-45 age group. More than 60% women living in rural areas belong to 26-35 age group and 36-45 age group compared to 47.13% in 18-25 age group and showed statistical significance ($p < 0.030$) (table 1).

Abnormal vaginal discharge was reported in 67.01% women in the 26-35 years age group followed by 60.56% in 36-45 years age group and 42.53% in 18-25 years age group. A significant difference was also found ($p < 0.001$). Feeling of burning or itching in genitalia, another symptom which was reported frequently by 69% in 36-45 years age group women compared to 62.89% women in 26-35 age group and 47.13% in 18-25 years age group women and showed statistically significant ($p < 0.011$). Among all age groups, women in the 26-35 years age group used more contraceptive (58.25%) compared to other two age groups ($p < 0.001$). BV was diagnosed using Nugent's diagnostic criteria. There were 215 (61.07%) women with normal Nugent score (NS 0-3), 84 (23.86%) with intermediate Nugent score (NS 4-6), and 53 (15.05%) with BV (NS 7-10). This difference was found to be statistically significant (0.006) (table 2). Vaginal pH was < 4.5 in 205 women, and $\text{pH} \geq 4.5$ was found in 147 women and found to be statistically significant differences ($p < 0.040$) (table 2). *Candida* infection was observed in 22.99%, 34.02% and 40.85% of women in 18-25, 26-35 and 36-45 age group respectively ($p < 0.049$) with the overall prevalence of 32.67%. Similarly, the prevalence of BV in 18-25, 26-35 and 36-45 age group was 28.74%, 40.21% and 47.89% respectively ($p < 0.042$) with the overall prevalence of 38.92% (figure 2). Women in the 36-45 age group used reusable cloths more (60.56%) compared to 51.55% in 26-35 age group and 33.33% in 18-25 age group women. However, women in 18-25 age group used more disposable (66.67%) compare to other two groups.

Variables	Age(N=352)			P
	18-25 Yrs. (N=87)	26-35 Yrs. (N=194)	36-45 Yrs. (N=71)	
Marital status				
Single, never married	17(19.54)	0	0	0.001
Married	70(80.46)	191(98.45)	68(95.77)	
Divorced/Widowed	0	3(1.55)	3(4.23)	
Religion				
Hindu	83(95.40)	175(90.21)	68(95.77)	0.362
Muslim	2(2.30)	14(7.22)	2(2.82)	
Christian	2(2.30)	5(2.58)	1(1.41)	
Caste/Tribe				
Scheduled caste (SC)	18(21.18)	31(16.40)	13(18.57)	0.416
Scheduled tribe (ST)	28(32.94)	70(37.04)	26(37.14)	
Other backward caste OBC)	23(27.06)	68(35.98)	20(28.57)	
General	16(18.82)	20(10.58)	11(15.71)	
Education				
No formal education	10(11.49)	27(13.92)	14(19.72)	0.002
5th - 10th grade	30(34.48)	108(55.67)	35(49.30)	
12th grade or higher	47(54.02)	59(30.41)	22(30.99)	
Occupation				
Employed	7(8.05)	32(16.49)	3(4.23)	0.039
Self-employed	22(25.29)	54(27.84)	20(28.17)	
Housewife	58(66.67)	108(55.65)	48(67.61)	
Number of people live in house				
1-2 individuals	19(21.84)	19(9.79)	7(9.86)	0.052
3-5 individuals	55(63.22)	149(76.80)	52(73.24)	
>6 individuals	13(14.94)	26(13.40)	12(16.90)	
Monthly Income				
< 5,000	9(10.34)	32(16.49)	10(14.08)	0.346
5,000-10,000	45(51.72)	87(44.85)	27(38.03)	
>10,000	33(37.93)	75(38.66)	34(47.89)	
Where Live				
Housing colony	24(27.59)	31(15.98)	9(12.68)	0.030
Urban slum	22(25.29)	37(19.07)	18(25.35)	
Rural/village	41(47.13)	126(64.95)	44(61.97)	

Table 1. Sociodemographic Status of Non-Pregnant Women Recruited in the Study

Variables	18-25 Yrs. (N=87)	26-35 Yrs. (N=194)	36-45 Yrs. (N=71)	P
Abnormal vaginal discharge				
No	50(57.47)	64(32.99)	28(39.44)	0.001
Yes	37(42.53)	130(67.01)	43(60.56)	
Feeling of burning or itching in genitalia				
No	46(52.87)	72 (37.11)	22(30.99)	0.011
Yes	41(47.13)	122(62.89)	49(69.01)	
Genital sores				
No	86(98.85)	186(95.88)	66(92.96)	0.167
Yes	1(1.15)	8(4.12)	5(7.04)	
Feeling of burning or itching when urinating				
No	52(59.77)	112(57.73)	39(54.93)	0.829
Yes	35(40.23)	82(42.27)	32(45.07)	
Strawberry cervix				
No	11(12.64)	24(12.37)	12(16.90)	0.615
Yes	76(87.36)	170(87.63)	59(83.10)	
Lower back pain				
No	47(54.02)	119(61.34)	43(60.56)	0.500
Yes	40(45.98)	75(38.66)	28(39.44)	
Use contraceptive				
No	60(73.17)	81(41.75)	45(63.38)	0.001
Yes	22(26.83)	113(58.25)	26(36.62)	
Nugent scoring				
0-3	62(71.26)	116(59.79)	37(52.11)	0.006
4-6	22(25.29)	41(21.13)	21(29.58)	
7 or more	3(3.45)	37(19.07)	13(18.31)	
pH cat				
<4.5	59(67.82)	112(57.73)	34(47.89)	0.040
≥ 4.5	28(32.18)	82(42.27)	37(52.11)	

Table 2. Clinical Presentation of Non-Pregnant Women Recruited in the Study

Variables	18-25 Yrs. (N=87)	26-35 Yrs. (N=194)	36-45 Yrs. (N=71)	P
Absorbent material used during last 6 cycles				
Disposable sanitary pads	58(66.67)	94(48.45)	28(39.44)	0.002
Reusable cloths/towel	29(33.33)	100(51.55)	43(60.56)	
Frequency of changing absorbent material in heavy days				
Once a day	39(44.83)	85(43.81)	44(61.97)	0.042
Twice a day	29(33.33)	79(40.72)	20(28.17)	
Three times a day or more	19(21.84)	30(15.46)	7(9.86)	
Where change absorbent material				
Inside the toilet facility	59(67.82)	121(62.37)	33(46.48)	0.018
Outside the toilet facility	28(32.18)	73(37.63)	38(53.52)	
Dry sanitary cloth				
Dry it in the sun or open space	17(58.62)	41(41.00)	13(30.23)	0.056
Dry it inside the house	12(41.38)	59(59.00)	30(69.77)	
How store cloth for next use				
Wrapped in polythene/paper/ container	16(55.17)	60(60.00)	27(62.79)	0.811
Without wrapping	13(44.83)	40(40.00)	16(37.21)	
Where store cloth for next use				
In the cupboard/selves along with other clothes	24(82.76)	75(75.00)	34(79.07)	0.647
In some place in the latrine or bathroom	5(17.24)	25(25.00)	9(20.93)	
Type of washing during Menstruation				
Only vaginal wash	72(82.56)	139(71.65)	45(63.38)	0.022
Bath of full body	15(17.44)	55(28.35)	26(36.62)	
How often wash yourself during menstruation				
Once a day	54(62.07)	128(67.02)	39(54.93)	0.189
Twice or more per day	33(37.93)	63(32.98)	32(45.07)	
Household drinking water				
Piped tap	29(33.33)	60(30.93)	20(28.17)	0.792
Tube well/borehole/protected well	43(49.43)	91(46.91)	33(46.48)	
Unprotected well	15(17.24)	43(22.16)	18(25.35)	

Table 3. Different Menstrual Hygiene Management Practices and WASH Access Variables of Non-Pregnant Women Recruited in the Study according to their Age Categories. Data are expressed in Number (%) of Women

The difference was found to be statistically significant ($p < 0.002$). When we assessed the different MHM practices, women in 36-45 age group changed absorbent material less frequently (61.97%) as compared to other two groups which were 43.81% and 44.83%. Women changing their absorbents somewhere other than in a toilet facility found to be significantly different among all three age groups ($p < 0.018$). Women in 18-25 years age group washed themselves less

frequently during menstruation (82.56%) followed by 71.65% in 26-35 years age group and 63.38% in 36-45 age group. The difference was statistically significant ($p < 0.022$) (table 3).

DISCUSSION

Three hundred and fifty-two women attending to the Obstetrics and Gynaecology outpatient department with the complaints of abnormal vaginal discharge, itching and burning of the genitalia, and other symptoms of the vaginitis were recruited in this study. Abnormal vaginal discharge and itching of genitalia was presented in around 60% of women although there was a significant difference observed across the ages of the women. Abnormal vaginal discharge and itching and burning has been found to be associated with occurrence of BV and candidiasis in many studies.²⁰⁻²² The prevalence of BV and candidiasis was found in 38.92% (137/352) and 32.67% (115/352) of women respectively. More than 35% of symptomatic women had BV in different studies such as Uganda,²³ Nairobi, Kenya,²⁴ Lagos,²⁵ Columbia,²⁶ Senegal,²⁷ and India.^{18,28-30} The differences in the prevalence of BV in various populations may be due to the different diagnostic criteria for BV, ethnicity, method of contraception etc.^{20,31-33} A high prevalence of candidiasis was also observed in women of Senegal,²⁷ Punjab,²⁸ Tanzania,³⁴ Kenya,³⁵ Israel,³⁶ Delhi,³⁷ and Laos.³⁸

In this study, BV was more prevalent among women in the age group of 36-45 years (47.89%) followed by 26-35 years age group (40.21%) and 18-25 years age groups (28.74%) with a statistically significant difference ($p = 0.040$). From the previous studies there were conflicting results on the association of age with the prevalence of BV in the reproductive age women. Our result is similar to the finding of Mulu et al., (2015) in Ethiopian and Jones et al., (2007) in Peru.¹⁰⁻¹¹ Like BV, the prevalence of candidiasis was found to be significantly high in women with more than 25 years old, which supports the finding of Fang et al., (2007) undertaken in rural area of Shandong, China.¹² The high prevalence of both BV and candidiasis in 26-45 years age of women may be due to the age being the most reproductively active age groups and high sexual exposure,²² pregnancy, weakening of immunity and use of contraceptive.¹⁰ Further it has been suggested the level of oestrogen reduced after age 40 years

which causes an increase in the pH level enhancing growth of microorganisms responsible for BV.¹⁰ The history of using contraception was significantly higher in 26-45 years of age women in this study. This is obvious because in the 18-25 age groups, around 20% of women were unmarried with no history of sexual exposure or contraception used. In a study undertaken in the same state of Odisha, the prevalence of BV and candidiasis was comparable in all the age groups of women.¹⁸

The high prevalence of BV and candidiasis in 36-45 years age groups in this study can be defined with the association of poor MHM practices as in this age groups, around 60% of women were used reusable clothes as absorbent materials ($p = 0.002$), 62% of women changed their absorbent materials once a day ($p = 0.042$), 53.52% of women changed their absorbent materials outside the toilet facilities ($p = 0.018$) and 60% of women reused the absorbent materials ($p = 0.002$). A poor MHM practices has been significantly associated with the occurrence of BV in a number of studies. The prevalence of BV was found to be higher in women using reusable clothes.^{18,39,40} low frequency of changing absorbent material,¹⁸ changing of absorbent material outside the toilet facilities,¹⁸ frequency of washing of genitalia during menstruation,^{37,41,42} douching etc.³¹

It has been observed that the poor MHM practices are associated with socio-demographic features. In this study, woman in the higher age groups had significantly high number of married women, low level of education, housewife (occupation), three or more number of peoples living in house, and living in rural areas (residence) compared to women in the low age groups. The prevalence of BV was found to be high in unmarried women,²⁴ whereas high in married women.¹¹ Lack of education or low level of education has been found to be significantly associated with occurrence of BV in many studies.^{12,39,43,44} The occurrence of BV was found to be higher in rural women,¹⁰ however in a study from India, a highest prevalence of women with BV were found in urban slums (38.6%) followed by rural area (28.8%) and then in rural middle class communities (25.4%).¹⁵ The prevalence of BV may also vary with the work type of the women.^{10,40} Similar to BV, the higher prevalence of candidiasis in higher age groups in this study may be due to the lack of education, low economic status and women staying with more than two persons in house etc.

There are certain limitations in this study as we have not investigated others infectious agents like *T. vaginalis*, Chlamydia, Gonorrhoeae etc. in vaginitis and inclusion of sexual history as variable that may affect the results as many of these women were residing in rural area, belonging to tribal communities and orthodox.

CONCLUSIONS

From the above discussion it can be concluded that the higher prevalence of BV and candidiasis in higher age groups of women in this study might be due to poor MHM practices and these poor MHM practices are due to their lack of higher education and other low socio-demographic conditions. An increased awareness for MHM practices among these women is important to combat the associated morbidities related to BV and candidiasis.

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