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ORIGINAL RESEARCH ARTICLE

Microbial Characterization and Risk Factors Associated with Abnormal Vaginal Discharge among Women in Katagum Local Government, Bauchi State, Nigeria

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ABSTRACT
Abnormal vaginal discharge presents a significant public health issue stemming from various infectious and non-infectious causes. This study sought to identify the microorganisms linked to abnormal vaginal discharge, evaluate associated risk factors, and determine its prevalence among women in Katagum Local Government, Bauchi State. A cross-sectional study involving 390 women was carried out at Extreme Hospital Azare. High vaginal swabs were collected and subjected to microbial isolation using MacConkey Agar and Sabouraud Dextrose Agar. Identification techniques such as Gram staining, biochemical tests, and the germ tube test were employed. The isolated microorganisms included *Staphylococcus aureus* (40%), *Candida spp.* (5.90%), *Klebsiella spp* (15.38%), *Proteus spp.* (9.49%), and *Escherichia coli* (15.13%). Notably, individuals from lower socioeconomic backgrounds and urban settings displayed a higher prevalence of abnormal vaginal discharge. Detailed documentation of gynecological symptoms like vulva itching, dysuria, dyspareunia, and lower abdominal pains was undertaken. Women aged 25-34 years exhibited a higher prevalence of microorganisms associated with abnormal vaginal discharge. The overall prevalence of abnormal vaginal discharge in the studied population was 47.7%. This study offers valuable insights into the microbial profile and associated risk factors, contributing to the understanding and potential management of abnormal vaginal discharge within the community.

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INTRODUCTION
Vaginal discharge is usually a normal physiological phenomenon that occurs during certain phases of the menstrual cycle, during sexual stimulation, or pregnancy. It is not contagious, colourless or white, non-irritating, and odourless or slightly scented. On the other hand, an unpleasant, non-bloody discharge in the female lower genital tracts is indicative of an infected vaginal discharge. Women across a variety of age groups and societies report this issue frequently, regardless of their sexual activity status (Abebe *et al.*, 2001). Depending on the type of infection, the discharge may be green, yellow, brown, or red in colour and come with a bad smell, itching, irritation, painful urination, or pain during sexual activity. The cervix, vagina, and other infections, and non-infectious factors like reactions to allergens, irritants, foreign bodies, estrogen deficiency, and rarely, systemic diseases can be the source of vaginal problems (Omole *et al.*, 2006).

Pelvic inflammatory disease, infertility, ectopic pregnancy, pelvic abscess, menstrual irregularities, spontaneous abortion, and premature birth are among the complications linked to vaginal infections. Abnormal vaginal discharge is extremely common, particularly in developing nations with low socioeconomic status like Egypt. The most common sign of sexually transmitted infections (STDs) and reproductive tract infections (RTIs) is abnormal vaginal discharge or AVD. Abnormal vaginal discharge is more common in women who use vaginal douches, sprays, and synthetic insertions—all harmful habits that negatively impact reproductive health (Sobel, 2015). A culture of silence surrounding abnormal vaginal discharge, acceptable health behaviors, and misperceptions among women about the reasons are all factors contributing to an increased incidence of this problem and its ramifications. Microbes connected to irregular vaginal discharge include bacterial vaginosis that arises from normal vaginal flora such as *Lactobacillus* exchange with mixed bacterial flora which consists of *Gardnerella vaginalis*, *Prevotellabivia*, *Prevotelladisiens*, *Prevotella* spp., *Peptostreptococcus* spp., *Mobiluncus* spp., and *Mycoplasmehominis*. (Machado *et al.*, 2016; Chenicheri *et al.*, 2017).

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Bacterial vaginosis (BV) is a polymicrobial illness characterized by an increase in the quantity and kinds of various bacteria in vaginal fluid together with a decrease in the typical vaginal flora, mostly hydrogen peroxide-producing Lactobacillus spp. Vaginal fluid's properties, such as its thickness and smell, can change as facultative and anaerobic bacteria proliferate and lactobacilli decrease (Koumans *et al*., 2007; Machado *et al*., 2017). Between 15 and 30 percent of non-pregnant women have bacterial vaginosis. Pregnancy rates range from 17% to 25% in Nigeria, according to independent studies done in the country's southeast, northeast, and southwest regions, respectively. Pregnancy rates in developed countries are roughly 11–16%, while in Kenya and South Africa, they are 21-29% (Adesiji *et al*., 2007; Nigeen *et al.,* 2015)

According to Rajshree *et al.* (2014), bacterial vaginosis is linked to a number of health problems, including endometritis, pelvic inflammatory disease, post-hysterectomy vaginal cuff cellulitis, and post-abortal sepsis. The risk of miscarriage, preterm labor, preterm delivery, chorioamnionitis, and postpartum problems like endometritis and wound infections are all increased when a woman has BV during her pregnancy. Although increased vaginal discharge is common during pregnancy, nonpathological, aberrant vaginal discharges are usually linked to trichomoniasis, candidiasis, and bacterial vaginosis. Unfortunately, due to insufficient research into alternative possible causes, a large number of cases with atypical vaginal discharge in pregnant women are mistakenly treated as candidiasis (Ibrahim *et al*., 2014).

Preventive measures aim to deal with the behaviors or risk factors connected to a certain disease. According to research, there are a number of risk factors and behaviors associated with bacterial vaginosis (BV), including age, marital status, employment status, occupation, recent use of antibiotics, reduced estrogen production, douching, sexual activity, earlier age at which a person has their first sexual encounter, more frequent episodes of receptive oral sex, use of spermicide, sexually transmitted diseases (STDs), working in the sex industry, smoking, alcohol consumption, stress, use of contraceptive methods, and race/ethnicity (Brumley, 2012: Singh *et al*., 2015). According to Vodstrcil *et al.* (2013), a number of observational studies have demonstrated that women who use hormonal contraceptives have a lower chance of experiencing a recurrence of BV. Among the noteworthy risk factors that are modifiable are sexual behavior and vaginal douching (Verstraelen *et al.,* 2010).

Despite this alarming information, there is a glaring lack of information and documentation on the epidemiology, risk factors, and socio-demographic determinants of these problems in Katagum Local Government Area, Bauchi State, Nigeria. This study aimed to characterize microorganisms associated with abnormal vaginal discharge and assess their associated risk factors and prevalence among women in Katagum Local Government, Bauchi State.

MATERIALS AND METHOD

Extreme Hospital Azare's ethics committee approved this study (reference number EHA/25/11/23/012). After being informed, every patient enrolled in the trial consented to participate in the study.

Data gathering

Three hundred and ninety high vaginal swabs were taken from the Extreme Hospital Azare gynecological unit and brought to the Faculty of Science, Bauchi State University Gadau, Microbiology Laboratory for microbiological analysis. In order to collect data on the common clinical aspects and risk factors of the infections, standardized structured questionnaires were also given to the patients at the time of sample collection.

Cheesbrough (2007) stated that the bacteria were isolated and identified by aseptically streaking the sample-containing swab stick over each Petri plate containing SDA and solidified MacConkey Agar. The plates were incubated for 24 hours at 37°C for bacteria and 35°C for Candida species. Gram-staining techniques and biochemical tests were used to identify the microorganisms.

RESULT

The current research findings indicated that *Staphylococcus aureus* was detected in 40% of patients experiencing abnormal vaginal discharge, while *Candida spp.* was found in 5.90%, *Klebsiella spp.* in 15.38%, *Proteus spp.* in 9.49%, and *Escherichia coli* in 15.13% of cases (Table 1).

Additionally, the study revealed that 21.03% of participants were aged 15-24, 36.41% were between 25 and 34, 15.90% were 35-44, 13.33% were 45-54, and 13.33% were over 55. Moreover, it was observed that 32.56% were single and 67.44% were married, with 13.85% being traders, 15.90% civil or public servants, 19.23% students, and 51.03% engaged in other occupations. Furthermore, 74.62% resided in urban areas and 25.38% in rural areas, with 50.77% from low-income families, 36.41% from middle-income families, and 12.82% from high-income families. Additionally, educational background varied, with 24.36% having primary education, 30.77% secondary, 19.23% post-secondary, and 25.64% having no formal education (Table 2).

The study also found that 29.49% reported vulva itching, 81.54% dysuria, 28.72% dyspareunia, and 58.21% lower abdominal pains, with most vaginal discharge being yellow (86.67%) and watery (81.54%), and 71.28% had a bad odour (Table 3).

Despite none reporting oral sex, sex work, smoking, or alcohol consumption, 25.64% recently used antibiotics, 71.79% were sexually active, 29.23% had sexually transmitted diseases, and contraceptive methods varied, with 30.26% pregnant (Table 3).

Table 1: Distribution of the microorganisms isolated from the vaginal discharge of the patients

Microorganisms isolated	Frequency	Percentage (%)
Staphylococcus aureus.	156	40.00%
Candida spp.	23	5.90%
Klebsiella spp.	60	15.38%
Proteus spp.	37	9.49%
Escherichia coli.	59	15.13%

Table 2: Demographic information of the patients

Factors	Variables	Frequency	Percentage (%)
Age	15-24	82	21.03
	25-34	142	36.41
	35-44	62	15.90
	45-54	52	13.33
	55 above	52	13.33
Marital Status	Single	127	32.56
	Married	263	67.44
Occupation	Traders	54	13.85
	Public/Civil Servant	62	15.90
	Students	75	19.23
	Others	199	51.03
Geography	City	291	74.62
	Village	99	25.38
Economic background	Low	198	50.77
	Middle	142	36.41
	High	50	12.82
Educational level	Primary	95	24.36
	Secondary	120	30.77
	Post-secondary	75	19.23
	None	100	25.64

Table 3: Clinical features and Risk factors of abnormal vaginal discharge

Clinical features	Applicable (%)	Not applicable
Vulva itching	115 (29.49)	275 (70.51)
Dysuria	318 (81.54)	72 (18.46)
Dyspareunia	112 (28.72)	278 (71.28)
Lower abdominal pains	227 (58.21)	163 (41.79)
Bad odour of the discharge	112 (28.72)	278 (71.28)
Colour of the discharge:		
White	26 (6.67)	
Yellow	338 (86.67)	
Grey	26 (6.67)	
Consistency of the discharge:		
Thick	52 (13.33)	
Watery	318 (81.54)	
Frothy	20 (5.13)	
Recent antibiotic use	100 (25.64)	290 (74.36)
Sexually activity	280 (71.79)	110 (28.21)
Practicing oral sex	0 (0)	390 (100)
Having sexually transmitted diseases	114 (29.23)	276 (70.77)
Engaging in sex work	0 (0)	390 (100)
Smoking	0 (0)	390 (100)
Alcohol consumption	0 (0)	390 (100)
Pregnancy	118 (30.26)	272 (69.74)
Contraceptive methods:		287(73.59)
Condoms	38 (9.74)	
IUCD	21 (5.38)	
Oral	15 (3.85)	
Injection	17 (4.35)	
Implant	12 (3.08)	

The overall prevalence of abnormal vaginal discharge in Katagum Local Government area was 47.7%, with *Staphylococcus aureus* being the most prevalent organism at 40%. Age-wise, prevalence was highest (23.59%) among those aged 25-34, followed by 10.51% in those aged 15-24, 5.90% in those aged 35-44, and 4.62% in those aged 45-54, and lowest (3.08%) in those over 50 (Figure 1).

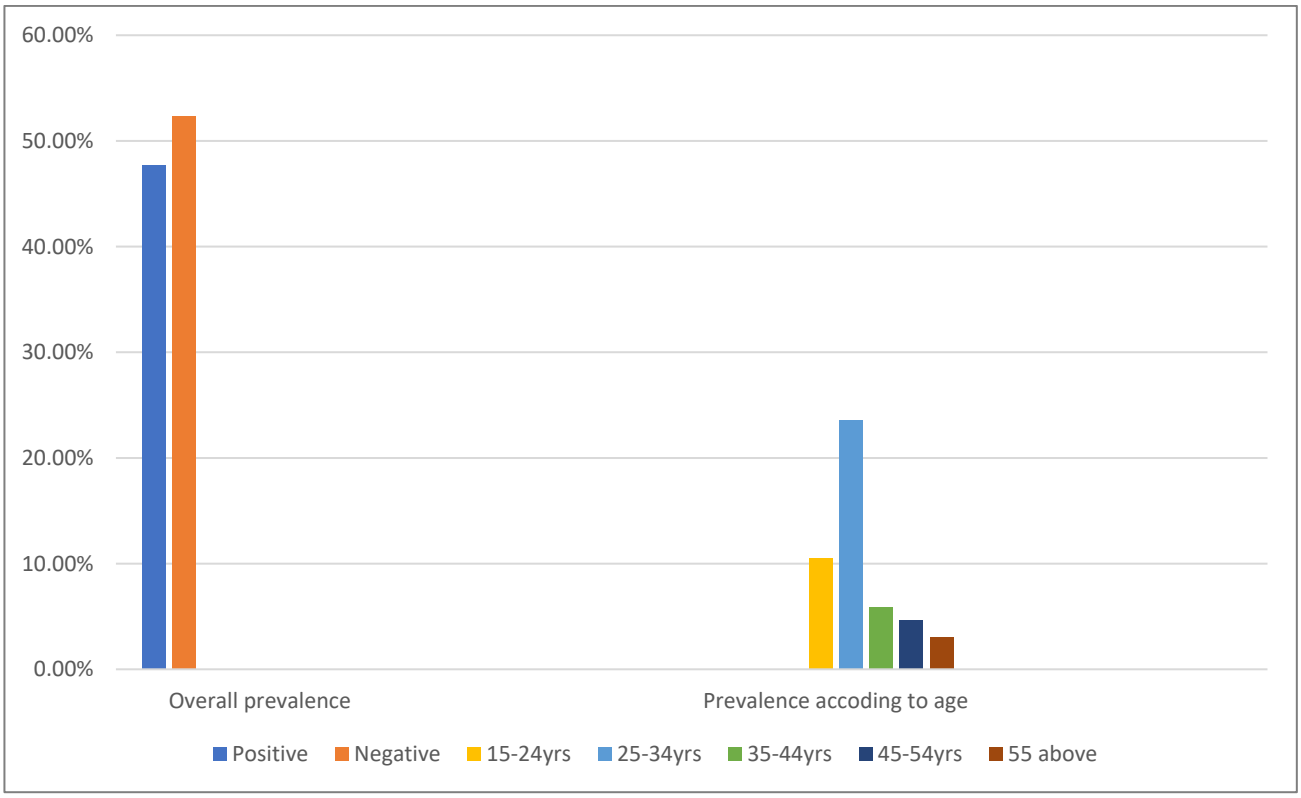

Figure 1: Prevalence of abnormal vaginal discharge

DISCUSSION

The results reported by Aduloju *et al.* (2019), showing a higher occurrence of abnormal vaginal discharge among married women and those with more sexual partners, are consistent with the present study, where 67.44% of patients reported such discharge, indicating a significant proportion in the study's sample. This similarity suggests a consistent trend across different populations, emphasizing the potential influence of marital status and sexual history on abnormal vaginal discharge prevalence. Using condoms consistently can reduce the risk of sexually transmitted infections (STIs) that can disrupt the vaginal flora. Also, limiting the number of sexual partners can reduce exposure to different bacterial strains. These can help in reducing the cases of abnormal vaginal discharge among the women.

Additionally, the current study revealed that most participants were from urban areas, echoing findings by Uwakwe *et al.* (2018), who also noted a higher prevalence of abnormal vaginal discharge among urban women. This association may be explained by the increased social activity typical of urban settings, including higher population density, diverse social networks, and greater mobility, all of which could contribute to heightened exposure to risk factors such as risky sexual behaviors. Recognizing the role of social and environmental factors in gynecological health is essential for developing targeted interventions and public health efforts. Both the present study and the research by Uwakwe *et al.* (2018) underscore the importance of comprehensive strategies addressing not only the biological aspects but also the socio-behavioral determinants contributing to observed differences in vaginal health.

Aduloju *et al.* (2019) presented intriguing findings on the link between multiparity, higher education, and abnormal vaginal discharge. Their study revealed that multiparous women with higher education levels are more likely to experience abnormal vaginal discharge, contradicting some previous research. This suggests that higher education might be associated with factors like increased awareness and a preference for conventional medicine, in contrast to the hypothesis that women without Western education may lean towards traditional practices, potentially contributing to such issues. Additionally, the study noted a notable difference in gynecological complaints compared to Uwakwe *et al.* (2018), particularly in the prevalence of vulva itching and lower abdominal pain.

Aduloju *et al.* (2019) provided insightful findings on how multiparity and higher education correlate with abnormal vaginal discharge. They found that multiparous women with higher education levels are more likely to experience

this issue, consistent with previous research by Ibrahim *et al.* (2014), Bitew *et al.* (2017), Nwadioha *et al.* (2010), and Ghattargi *et al.* (2018). However, these results diverge from other studies, indicating a lower prevalence among educated women. This suggests that higher education may be linked to factors like awareness and a preference for conventional medicine, contrasting with the belief that women without Western education may resort to traditional practices, potentially contributing to vaginal discharge issues. Additionally, this study uncovered a significant difference in gynecological complaints compared to Uwakwe *et al.* (2018), particularly in the prevalence of vulva itching, which was more common in their study but less so in the current one. Instead, lower abdominal pain emerged as the primary complaint in the current study, aligning with findings from Sivaranjini *et al.* (2013) and Zaher *et al.* (2017).

This study offered valuable insights into the sexual and contraceptive behaviors of participants and their correlation with abnormal vaginal discharge. Notably, none of the patients engaged in oral sex, sex work, smoking, or alcohol consumption, indicating a controlled environment for assessing factors influencing abnormal vaginal discharge.

One significant finding was that 25.64% of participants recently used antibiotics, raising questions about the potential link between antibiotic usage and abnormal vaginal discharge, prompting further investigation. Sexual activity patterns showed that most patients were sexually active, with 29.23% having a history of sexually transmitted diseases, suggesting a potential association between sexual activity and abnormal vaginal discharge. This aligns with previous research by Ibrahim *et al.* (2014) and Ghattargi *et al.* (2018), indicating that sexually active women have higher rates of abnormal vaginal discharge.

Contraceptive methods also played a role, with a small percentage using condoms and other methods, while the majority (73.59%) were not using contraceptives. Interestingly, the prevalence of abnormal vaginal discharge did not directly correlate with the type of contraceptive method used, indicating a multifactorial nature of the condition. Only a small proportion of patients were pregnant, and the association between pregnancy and abnormal vaginal discharge is complex, potentially involving hormonal changes, immune responses, or other factors. The literature review indicated that sexual behavior-related characteristics, such as the number of lifetime male sex partners and recent history of new sex partners, are consistently associated with abnormal vaginal discharge, aligning with the current study's findings. Discussing with healthcare providers on the best contraceptive methods that may likely not increase the risk of abnormal vaginal discharge, opting for contraceptive methods that do not disrupt the vaginal flora, such as non-spermicidal condoms or hormonal methods, can help in mitigating the problem of abnormal vaginal discharge among women.

The occurrence of microorganisms linked to abnormal vaginal discharge varies across different populations and regions, as evidenced by various studies. Factors such as geographic and cultural differences, variations in hygiene practices, sexual behaviors, healthcare access, and socioeconomic conditions may contribute to these variations in prevalence rates.

The current study's identification of various bacterial species emphasized the intricate nature of vaginal microflora and emphasized the importance of pinpointing specific pathogens linked to this clinical issue. *Staphylococcus aureus* emerged as the most commonly isolated pathogen, signaling potential concerns regarding its role in gynecological infections. While *Candida spp.* were found in 5.90% of cases, a lower proportion compared to *Staphylococcus aureus*, their presence indicated fungal infections in some patients, highlighting the polymicrobial nature of abnormal vaginal discharge. These findings contrast with previous studies by Nwadioha *et al.* (2010), Nwakedi and Anyiam (2003), and Sobel *et al.* (1998), which reported *Candida spp.* as the most prevalent agent associated with abnormal vaginal discharge, with prevalence rates ranging from 40% to 60%. The discrepancies underscore the variability in microbial patterns across different populations and geographic locations, influenced by lifestyle, hygiene practices, sexual behaviors, and overall health status.

The study also revealed a clear association between age and abnormal vaginal discharge, notably showing a higher prevalence (23.59%) among patients aged 25-34 years. This age group appeared to be more susceptible to the condition, consistent with findings from previous studies by Aduloju *et al.* (2019) and Asiegbu *et al.* (2018).

CONCLUSION

The current research unveiled a wide range of microorganisms linked to abnormal vaginal discharge, with *Staphylococcus aureus* emerging as the most common. Particularly noteworthy is the highest prevalence of abnormal vaginal discharge observed among women aged 25-34 years, underscoring the importance of reproductive age in addressing this health issue. Common gynecological complaints among patients included vulva itching, dysuria, dyspareunia, and lower abdominal pains. The study also highlighted an overall prevalence of abnormal vaginal discharge in the study area, reaching 47.7%, highlighting its significant impact on the community's health.

Based on the findings of the current study, it is recommended that further studies should be conducted to assess the incidence and relapse of abnormal vaginal discharge over time, sanctioning a better understanding of the persistence and patterns of this condition among women in the community.

Also, investigating the efficacy of different treatment modalities as well as antimicrobial therapies and probiotics, in managing abnormal vaginal discharge and

reducing the associated microbial burden and symptoms are recommended for further studies.

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