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Assessment of vaginal health before and after treatment with vaginal suppository containing *Lactiplantibacillus pentosus* KCA1

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Abstract

Bacterial Vaginosis (BV) is a polymicrobial syndrome characterized by a shift in the vaginal flora from a predominant population of *Lactobacilli* to a replacement with anaerobes. Vaginal suppositories containing *L. pentosus* KCA1 were formulated using glycerol-gelatin base. A prospective and follow-up community-based study was done. Vaginal samples were collected from women of reproductive age (non-pregnant) between 18-45 years. A total of 360 women both symptomatic and asymptomatic provided High Vaginal Swabs (HVS) for BV screening using Nugent scoring method and 65 (18.1 %) participants were identified as having BV by microscopy with 45 (12.5 %) of them being consistent with BV (Nugent score of 7-10) and twenty (5.56 %) being intermediate with BV (Nugent score of 4-6). A baseline and intervention questionnaire were administered to the participants. Majority (81.5 %) of the participants affirmed that they have not heard about BV. Social burden reveals that 90.8 % affirmed that they feel frustrated, having BV symptoms recur after treatment and 83.1 % admitted that BV symptoms makes them feel embarrassed, ashamed and dirty. Majority (58.8 %) claimed that the state of their reproductive health is 'very good' four weeks after treatment, while 88.2 % of the participants rated their reproductive health after four weeks of treatment to be 'somewhat better than now than a year ago'. In conclusion, it was revealed that BV has impact on the social status and quality of life of the participants except on their economic status. Knowledge on the awareness of BV among women of reproductive age is essential.

Keywords: Bacterial Vaginosis; Burden; Reproductive; Participant; *Lactiplantibacillus pentosus* KCA1; Vaginal Suppository

1. Introduction

Bacterial Vaginosis (BV) is a polymicrobial syndrome characterized by a shift in the vaginal flora from a predominant population of lactobacilli to anaerobes such as Gardnerella vaginalis, *Prevotella*, *Bacteroides, Veillonella, Peptostreptococcus*, and *Mobiluncus* species, as well as other bacteria such as *Mycoplasma* and *Ureaplasma* species, due to an increase in the pH of the vaginal fluid [1]. It is the most common cause of abnormal vaginal discharge in women of childbearing age. The symptoms of a thin, white or yellow vaginal discharge with a pH more than 4.5, apparent after

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intercourse and menses, and accompanied by a fishy odor are so common [2,3]. Other BV diagnostic markers include the presence of clue cells, a modest number (1/hpf) of polymorphornuclear leucocytes, and few or no lactobacilli [4]. Because almost half of all women are asymptomatic with BV, the true prevalence of the disease is hidden [5,6]. The prevalence of BV in Africa has been estimated to be between 30% and 50% [7]. In addition, these authors found that 14.2 % of Nigerian women have BV. In the eastern portion of Nigeria, women had a high BV prevalence of 40.8 % [8]. Women are predisposed to BV due to a number of behavioral variables. Multiple / new sex partners, consistent douching, contraceptive (IUD) use, and first intercourse at a young age are only a few of these factors [9,10,11,12,13]. Cigarette use [14] and female genital mutilation [15] are two more factors. Pregnancy complications linked to BV include second-trimester miscarriage and preterm birth [16], early failure of in vitro fertilization, increased risk of upper genital tract infection after pregnancy termination, and an increased risk of infective complications after hysterectomy [16,17]. BV has also been linked to an increased risk of sexually transmitted infections including HIV infection [18,19]. H_2O_2 inhibits HIV's capacity to infect cells in vitro [20], and its lack in BV could be one of the reasons for this.

Oral or vaginal antibiotics such as metronidazole or clindamycin are advised for BV treatment, although there is still an increased number of BV recurrences after antibiotic treatment [21,22]. Recurrence rates of up to 60% within 12 months after treatment have been reported in studies [23]. Recurrent BV has been shown to have a negative impact on women's social, health, sexual, emotional, personal, and work relationships [1,9,24,25] and thus their quality of life [1,9,24,26]. As a result, it's critical to develop an alternative BV treatment. The use of probiotics in the treatment of BV has become common in industrialized nations. However, it is yet to be accepted as an alternative treatment in Nigeria. Probiotics serve to replace pathogenic organisms that have reduced lactobacilli by creating by-products such as lactic acids, hydrogen peroxide, and bacteriocins, which aid in the reduction of pathogenic organism abundance, allowing lactobacilli to multiply and redeem the vaginal microbiome. Although research has been done on BV prevalence and risk factors, there is still a lack of data on BV awareness and the emotional, sexual, and social consequences of BV on women. Furthermore, just one study has been conducted on the impact of recurring BV on women's financial lives [25].

The purpose of this study is to determine the prevalence of BV among women in Anambra State, Nigeria's eastern region, as well as the impact of recurring BV on their socioeconomic level and quality of life.

2. Material and methods

2.1. Study design

This was a prospective and follow-up community-based study, where vaginal samples were collected from women of reproductive (non-pregnant) for the diagnosis of BV using Nugent's score. Convenient random sampling techniques was employed for the recruitment of subjects.

2.2. Study area

This study was conducted in Oko community in Orumba North Local Government Area, in Anambra state, Nigeria. They were mostly student from Federal Polytechnic Oko and few subjects in the Federal Polytechnic Oko environs. Because of the nature of the study which involves application of the formulation suppositories, participants that will probably have less challenge convincing for further follow-up studies were considered. Formulation of the vaginal suppository and Laboratory analysis were carried out in the Microbiology department at National Agency for Food and Drug Administration and Control (NAFDAC) Zonal laboratory, Agulu, Anambra State. And identification of bacteria that were associated with bacterial vaginosis using Nugent score method was carried out at Department of Pharmaceutical Microbiology and Biotechnology, Faculty of Pharmaceutical Sciences, Nnamdi Azikiwe University, Awka Anambra State, Nigeria.

2.3. Study Participant

Study participants comprised of non-pregnant women, who met the inclusive and exclusive criteria for the study and who gave their consent.

2.4. Sample size

The sample size for the study was 370 women, calculated using this formula

$N=Z^2p\ (1-p)\ /\ d^2$ Where, N is the Sample size; Z is the z-value of 1.96 for confidence limit of 95%; p is the prevalence rate and d is the margin of error.

Based on the prevalence of BV of 40.1 % reported by [27] with Margin of error of 5 % (0.05)

2.5. Subject Recruitment and duration of study

A total of 360 women volunteers within (18-45) years was recruited for this study between July 2018 to January 2019.

2.5.1. The inclusion criteria for the participant include

All sexually active women (18-45) years who are symptomatic or asymptomatic to Bacterial Vaginosis (BV), who have BV as diagnosed by Nugent score.

2.5.2. The exclusion criteria

Women on their monthly menstruation, those receiving antibiotic treatment within 7 days of the study, those that are pregnant, those that are diabetic, those that are breastfeeding, those with no recent vaginal douching, those with no known hypersensitivity to probiotics, those that are immunocompromised or on corticosteroid or on immunosuppression therapy.

2.6. Study Instrument

After counselling, oral consent was obtained from the participants after thoroughly educating them about the study and participants were administered a standardized questionnaire to answer in order to obtain their behavioural data and socio-demographic data (on sex, age, marital status and etcetera). Thereafter, participants were given a sterile cotton swab for vaginal sample collection.

2.7. Evaluation and Modification of Questionnaires

The questionnaires were evaluated by an experienced data analyst and modifications were made where necessary.

3. Results and discussion

With a prevalence of 9-37 percent depending on the demographic investigated, BV is the most prevalent cause of vaginal discharge among women of reproductive age [16]. In Africa, the prevalence is estimated to be between 30 and 50 percent [7].

In the current study, the total prevalence of BV among women of reproductive age was 18.1 percent. This current study was supported by the study done by Anukam and Reid [7], that reported 14.2% prevalence rate of BV among Nigerian women and 17.3 % that was reported by Ibrahim *et al*., [28], in North-Eastern part of Nigeria, among pregnant women. This study contrasted with Adinma *et al*., [8], who found a high prevalence of 40.8 percent among women in the Eastern region of Nigeria, and Wariso *et al*., [29], who found a prevalence rate of 51 percent in Port Harcourt, Nigeria. Globally, 20 to 30 % of reproductive-aged women visiting sexually transmitted infection (STI) clinics are infected with BV, with incidence as high as 50 percent to 60 percent in high-risk populations including commercial sex workers [30]. BV prevalence was reported to be 50% in Zimbabwe [31], 38% in Cameroon among women who performed vaginal douching [32], and 27% in Peruvian women from socioeconomically disadvantaged families. The variation in prevalence could be attributed to the sampled population's quality and clinical status.

From the baseline questionnaire (administered before treatment), Table 1 below shows the demographic data of respondents that participated in the study.

Table 1 shows that the age group 25-31 had the highest prevalence of BV 27 (41.5 %) in this study, followed by the age group 18-24 with a prevalence of 18 (27.7 %). Previous research by Wariso *et al*., [29] in Nigeria and Muvunyi and Hernandez [33] in the United States found that the highest prevalence was found in the age range 26-30 years, followed by the age group 21-25 years, which falls within the age categories in the current study. In contrast, Okoli *et al.,* [34] found that the highest frequency was seen in the age range 18-24, with a prevalence of (23.81 %). In the current study, the age group 32-38 had a prevalence of 9 (13.8 %), whereas the age group 39-45 had a prevalence of 11 (16.9%). The rise in prevalence of the age group 25-32 may be due to the fact that most unmarried and married women are in this age range, and some of them have admitted to having many sexual partners or engaging in sexual infidelity whilst in school.

Table 1 Baseline Questionnaire (Before Treatment) showing the Demographic data of the Participants/ Volunteers

Characteristics	Frequency	Percentage (%)
Age (years)		
18-24	18	27.7
25-31	27	41.5
32-38	9	13.8
39-45	11	16.9
Marital status		
Married	22	33.8
Unmarried	43	66.1
Religious status		
Christian	65	100
Muslim	0	0
Pagan	0	0
Others	0	0
Educational levels		
Primary (FSLC)	7	10.8
Secondary school certificate	8	12.3
Tertiary	50	76.9

All of the respondents had some sort of education, although the bulk of them 50(76.9 %) had tertiary education, followed by respondents with secondary education 8(12.3 %), and respondents with primary education 7(10.8 %). This is similar to and supports the findings of Ejike *et al.,* [25], who found that respondents with tertiary education had the highest prevalence 80 (95.2%), followed by secondary education 3 (3.6%), and primary education 1 (1.2 %). This could be because these respondents are in a tertiary institution where they have no parental guidance and are so free to live their life as they choose. This was in contrast to research by Wariso *et al.,* [29] and Okoli *et al.,* [34], which found that respondents with secondary education had the greatest prevalence rate of BV, followed by tertiary education and primary education. This could be attributable to the conditions in which the study was conducted.

Table 2 Baseline Questionnaire (Before Treatment) showing the Number and Percentage of Participants/Volunteers with Knowledge on Bacterial Vaginosis (BV)

Variables	Frequency	Percentage (%)
Knowledge on BV		
Have you heard of BV		
Agree	12	18.5
Disagree	53	81.5
Do you know that BV can increase the risk of HIV transmission		
Agree	1	1.5
Disagree	64	98.5
Do you know that BV can increase the risk of contracting STDs		
Agree	1	1.5
Disagree	64	98.5
Do you know that BV can increase the risk of delivering a low birth and premature baby		
Agree	5	7.7
Disagree	60	92.3

Table 2 shows the respondents' knowledge of Bacterial Vaginosis (BV). The bulk of the respondents 53 (81.5%) had never heard of BV, whereas only 12 (18.5%) have heard of BV. This was in contrast to the findings of Ejike *et al.,* [25], who reported that 66 (79.5%) of people were aware of BV. This could be due to the fact that the study was carried out among people in medical profession. Majority (98.5%) of the participants did not agree to have any knowledge on the BV predisposing risks (like HIV transmission, contracting STDs and delivering a low birth and premature baby). This could be due to the fact that the respondents are largely polytechnic students, and the majority of the courses taught are not health-related, thus it's conceivable they haven't heard of the term "BV."

Table 3 Baseline Questionnaire (Before Treatment) showing the Assessment of social burden on Participants/Volunteers infected with BV

Variable	Frequency	Percentage (%)
Multiple sexual partners		
Agree	19	29.2
Disagree	46	70.8
Indifferent	0	0
Feeling of frustration of having BV symptoms recur after Treatment		
Agree	59	90.8
Disagree	2	3.1
Indifferent	4	6.2
Dissatisfaction with the current treatment regimens for BV management		
Agree	38	58.5
Disagree	11	16.9
Indifferent	16	24.6
Does the symptoms of BV make you feel embarrassed, ashamed and 'dirty'		
Agree	54	83.1
Disagree	3	4.6
Indifferent	8	12.3
Does the symptoms of BV restrict you from partner intimacy		
Agree	38	58.5
Disagree	18	27.7
Indifferent	9	13.8
Do you share underwear with infected persons		
Agree	2	3.1
Disagree	63	96.9
Indifferent	0	0
Do you feel confused about why you experience recurrent BV		
Agree	65	100
Disagree	0	0
Indifferent	0	0
Do you feel frustrated at your lack of control over recurrence of BV		
Agree	65	100
Disagree	0	0
Indifferent	0	0

On the social burden of BV on women (Table 3), 19(29.2%) of the respondents agreed that they have multiple sexual partners which is one of the predisposing factors for BV while 46(70.8 %) dissent to having multiple sexual partners. This rise in the number of respondents who decline to have many sexual partners could be due to the fact that many

people (married and unmarried) do not want to reveal any concerns about sexual infidelity (married) or be perceived as sexually promiscuous (unmarried) [35]. This is similar to the percentage prevalence of the respondents that have multiple sexual partners 31(23.0%) in the study done by [25].

The respondents shared a variety of experiences; few admitted that BV had no impact on their social life, and the majority of the participants expressed dissatisfaction at having BV symptoms resurface after therapy 59(90.8%), feeling of embarrassment, shame and dirty 54(83.1%) when compared to the previous study by Payne *et al.,* [26] and Ejike *et al*., [25], this was quite high, feeling of confusion about why they experience recurrent BV 65(100%) and the feeling of frustration at their lack of control over the recurrence of BV 65(100%). Majority of the respondents acknowledged 38(58.5%) that they are dissatisfied with the current treatment regime for BV, whereas, 11(16.9%) dissent that they are dissatisfied with the current treatment regimen and 16(24.6%) are indifferent with the current BV treatment regimen.

38(58.5%) of the respondents acknowledged that the symptoms of BV restrict them from partner intimacy and 18(27.7%) disagreed to the restriction from partner intimacy while a few 9(13.8%) are indifferent about the restriction from partner intimacy. Recurrent BV is a distressing illness for many women, according to prior studies, and it can have a significant influence on self-esteem, sexual relationships, and quality of life [11]. Also, according to Ejike *et al.,* [25], 53.7 % of the participants in the study avoided having sex with their partners owing to self-consciousness over the vaginal bad odor. In addition, Payne *et al.,* [26] found that self-consciousness over vaginal smell led to avoidance or abstention from sexual activity. Majority 63(96.9%) of the participants did not acknowledge sharing of their underwear with infected persons and the 2(3.1%) of the participants that confirmed to be sharing undergarment with friends especially roommates, claimed that they would not know if they have been infected with BV.

Table 4 Baseline Questionnaire (Before Treatment) showing the Assessment of Economic burden on Participants/Volunteers infected with BV

Variables	Frequency	Percentage (%)
Does the Recurrence of Bacterial Vaginosis (BV)		
Cause you to visit hospital more often (affect your work/ business attendance negatively)		
Agree	4	6.2
Disagree	61	93.8
Affect your Job/Business performance and productivity		
Agree	0	0
Disagree	65	100
Cause you out-of-pocket expenses		
Agree	7	10.8
Disagree	58	89.2
Cause you additional treatment cost and loss of productivity		
Agree	2	3.1
Disagree	63	96.9

This study also evaluated the impact of BV on the Economic lives of the participants in Table 4. Majority 61(93.8%) of the participants' dissent to the fact that BV recurrence could cause them to visit hospital more often, hence their work/businesses attendance are not affected negatively. This was in support with the study of Ejike *et al*., [25], on the responses of medical personnel about how often their patient complained about recurrences of the BV infection. This could also be because most women do not believe it is necessary to speak with a health professional about their BV infection because doing so would entail spending money or incurring unplanned expenses, which would likely have a negative impact on their jobs or businesses, so they prefer to self-medicate. Hundred percent 65(100%) of the respondents did not acknowledge that the recurrence of BV affected their jobs/business performance or productivity. This was in line with a study by Bilardi *et al*., [11], which found that having BV had no effect on respondents' employment

except for commercial sex workers, despite the fact that the job/business in question is not commercial sex work. Majority 58 (89.2 %) disagreed that the BV recurrence could cause out-of-pocket expenses for them while 7 (10.8%) affirmed otherwise. This could be due to the fact that the majority of respondents do not visit the hospital as frequently as they should because the average Nigerian prefers to self-medicate unless their health problem becomes out of hand. This may also be due to the fact that most BV cases are asymptomatic, therefore victims are unaware of the need to visit a clinic. Therefore, the low prevalence rate of the respondents that agreed to be having out of pocket expenses (10.8%) are the population that visit the hospital. This is consistent with the findings of Ejike *et al.,* [25], who reported that the medical practitioners confirmed that about 16 % of female patients often complains about BV recurrence. By implication, only the 16 %, that visit the hospital to complain about BV recurrence are the ones having out-of-pocket expenses.

Majority 63(96.9 %) of the respondents did not acknowledge that BV recurrence could cause them additional treatment cost and loss of productivity. Given the conclusions of the paper on the economic impact of BV on women. The average cost of treatment is estimated to be #5000 (14 USD) [25]. This would undoubtedly have a compounding effect on the finances of a low-income lady in Nigeria (where the majority of the population survives on less than one dollar per day), particularly unemployed students.

Table 5 Baseline Questionnaire (Before Treatment) showing the Assessment on the Quality of life of Participants/Volunteers infected with BV

Variables	Frequency	Percentage (%)
Does the Recurrence of Bacterial Vaginosis (BV)		
Place a strain on your romantic relationship and self-image		
Agree	47	72.3
Disagree	18	27.7
Stress you (that is, does it take a serious mental-toll)		
Agree	5	7.7
Disagree	60	92.3

Table 5 reveals the assessment of quality of life of respondents living with BV. Majority 47(72.3%) of respondents acknowledged that the recurrence of BV places a strain on their romantic relationships and self-image, while 18(27.7%) of the respondents did not acknowledge the fact that the BV recurrence places a strain on their romantic relationships and self-image. This was in support to the findings of Ejike *et al*., [25] and Bilardi *et al*., [11]. Still on this study, it was also revealed that majority 60(92.3%) of the respondents did not agree that recurrence of BV could stress them or take a mental toll of them, while few 5(7.7 %) acknowledged the fact. This is the last thing on the minds of the average Nigerian (particularly the poor). They are preoccupied with various matters (financial, relationships, and work-related) that can generate stress. Again, this is likely due to the fact that most of them are unaware of the danger or risk connected with BV infection, and hence do not view it as a challenge that should cause them concern.

This study also evaluated the participants overall state of reproductive health after treatment (intervention study) with the formulated vaginal suppository containing *Lactiplantibacillus pentosus* KCA1 in Table 6. Majority 10(58.8%) of the respondents acknowledged that the state of their reproductive health after treatment was 'very good', 5 (29.4 %) of the respondents acknowledged that the state of their reproductive health after treatment was 'good' and 2(11.8%) acknowledged that it was 'fair'. This may probably be dependent on the level (Nugent score) of the BV infection on the subject, the heavier the infection rate the less likely it was for the participant to have any noticeable improvement on their reproductive health, because of the extent to which the probiotics used could exert its effects. This could also be because not all the BV causative agents were completely eradicated after treatment, as shown in the result obtained from the metagenomics analysis done with the vaginal samples of the participants after treatment (AT), as will be revealed in our next research. In this study, majority of 15 (88.2 %) of the participants acknowledged that their reproductive health does not cause them pain during sexual intercourse, while few 2(11.8%) acknowledged that they experienced 'mild' pain during sexual intercourse. This could result from the fact that most of the participant, if not all have returned back to their sexual activities, since the intervention questionnaire was administered to four weeks after treatment. On the other hand, majority 16 (94.1%) of the respondents acknowledged that their reproductive health

does not cause them to have sensation/irritation during urination, while few 1(5.9%) of the respondents confirmed that their reproductive health causes them to have sensation/irritation during urination 'slightly'. Individual differences cannot be overstated, as the human body responds to illness and therapy in varied ways.

Table 6 Intervention Questionnaire (After Treatment) showing the Assessment/Evaluation of Participants overall state of Reproductive Health After Treatment with the Formulated Vaginal suppository containing *Lactiplantibacillus pentosus* KCA1

Variables	**Frequency**	**%**	**Variables**	**Frequency**	**%**
State of your reproductive health			Accomplished less than you would like		
Excellent	0	0	Yes	0	0
Very good	10	58.8	No	17	100
Good	5	29.4	Spending more than budgeted		
Fair	2	11.8	Yes	1	5.9
Poor	0	0	No	16	94.1
Rate your Reproductive Health in general now			During the past 4 weeks, does the treatment have effect on your social life.		
Much better than a year ago	0	0	Do you feel dissatisfied with the current BV regimen?		
Somewhat better now than a year ago	15	88.2	Not at all	15	88.2
About the same as a year ago	2	11.8	Slightly	2	11.8
Somewhat worse now than a year ago	0	0	Moderately	0	0
Much worse now than a year ago	0	0	Extremely	0	0
Does your Reproductive health limit you in these activities			Do you Still have BV symptoms?		
Cause pain during sexual intercourse			Not at all	5	29.4
Severe	0	0	Slightly	11	64.7
Very severe	0	0	Moderately	1	5.9
None	15	88.2	Extremely	0	0
Very mild	2	11.8	Are you still restricted from partner intimacy?		
Moderate	0	0	Not at all	14	82.4
Cause sensation/irritation during urination			Slightly	3	17.6
Severe	0	0	Moderately	0	0
Very severe	0	0	Extremely		
None	16	94.1	Seem to get BV symptoms a little easier than other people		
Very mild	1	5.9	True	0	0
Moderate	0	0	False	0	0
During the past 4 weeks, how much do you think the treatment has on your quality of life			Don't know	17	100
Mental stress			Healthy as anybody I know		

Not at all	16	94.1	True	9	52.9
Slightly	1	5.9	False	0	0
Extremely	0	0	Don't know	8	47.1
Moderately	0	0	Expects my health to get worse		
Strain on your romantic relationship/self-image			True	0	0
Not at all	13	76.5	False	17	100
Slightly	4	23.5	Don't know	0	0
Extremely	0	0	My health is excellent		
Moderately	0	0	True	11	64.7
During the past 4 weeks, do you have any of the following problems in your work/business			False	0	0
Cut down on the amount of time spent on work			Don't know	6	35.3
Yes	0	0			
No	17	100			

Again, during the past four weeks after treatment, majority 16(94.1 %) of the respondents acknowledged that the treatment did not at all affect their quality of life, that is, by inducing any form of mental stress on them while 1 (5.9 %) of them did report that she was affected 'slightly'. It's probably because most of them believe they have been treated and as such they have no need to be worried again. Majority 13(76.5%) of the respondents acknowledged that they were not at all strained on their romantic relationship and self-image, while 4(23.5%) affirmed they were affected 'slightly'. Even though some of the respondents might still be having BV symptoms slightly considering the outcome of the metagenomics result after treatment which did not show a complete eradication of BV causative microbes. Also, their psychology might also be manipulating them; since they have been in a situation that affected the self-image during vaginal intimacy, it is possible that the fear of jeopardizing their relationship could lead them into becoming on ease hence affecting their relationship or self-image (consciousness) [26].

During the past four weeks, majority of the respondents indicated that they did not experience any problem in their work/ business, which might have led to cutting down on the amount of time spent at work (100 %) or accomplishing less than they would like to (100%) or spending more than they budgeted (94.1%). This is probably because during the past four weeks, they have not visited the hospital or self-medicated since they are still monitoring the effect of the therapy on their reproductive health.

Again, during the past four weeks, majority 15(88.2%) of the respondents indicated that the treatment did not at all affect their social life, in other words they did not feel dissatisfied with the current BV regimen, while 2(11.8%) had a feeling of dissatisfaction on the current BV regimen that was administered, resulting from the stains that they formulated suppositories leaves on their undergarments. 11(64.7 %) of the respondents indicated that they are still having the BV symptoms 'slightly', 1 (5.9 %) affirmed 'moderately' and 5 (29.4 %) indicated 'not at all'. This is still the case of the probiotics not being able to completely eradicated the BV causative agents. About 14 (82.4 %) of the respondents acknowledged that they are still restricted from partner intimacy, while 3(17.6 %) indicated that they are still restricted 'slightly'. This might be because the recovery process is still in progress or that they resumed sexual activities quite sooner before the probiotics could complete adherence to the vaginal epithelium for subsequent dislodgement of the BV microbes that has probably form a biofilm in the vagina walls.

Majority of the respondents indicated that they 'don't know' if they get BV symptoms a little easier than other people. Also, about (52.9 %) of the respondents indicated that they are as healthy as anybody they know and the remaining 47.1 % feels otherwise, that is, that they 'don't know'. This may be true because nobody can say for certain, what is going on in another person body system. Furthermore, about 64.7 % of the respondents indicated that their health is excellent while 35.3 % indicates that they don't know. These responses may be because some individuals are so skeptical about

certain sensitive issues like their health and wouldn't want to give their response without thorough observation of their reproductive health, which probably took them a longer time to arrive at a conclusion.

4. Conclusion

In conclusion, the study found that BV has an impact on Nigerian women's social, sexual, and emotional status, as well as their quality of life, but has no effect on their economic standing. As a result, it is critical to recognize that what women's experiences during BV episodes can go much beyond physical symptoms.

Recommendation

Based on the findings from this research it is recommended that; health educational campaigns employing various media channels are needed to educate the people about the impact of BV.

Compliance with ethical standards

Acknowledgments

We acknowledged with thanks all the volunteers.

Disclosure of conflict of interest

The authors declared no conflict of interest.

Statement of ethical approval

Ethical approval for the study was obtained from the ethics committee of Chukwuemeka Odumegwu Ojukwu University Teaching Hospital, Awka Anambra State, with approval number COOUTH/AA/VOL. 071.

Statement of informed consent

After counselling, oral consent was obtained from the participants after thoroughly educating them about the study.

Author's contributions

This work was carried out and approved in collaboration between all the authors who take responsibility for its intellectual contents, accuracy and integrity. KCA, and COE designed the study; KCA and INE sourced for funding; INE and KCA wrote the protocol; INE and KCA contributed in literature search; INE, CRC and JOI administered the questionnaire; INE and UCM did the statistical data analysis; INE and KCA did the discussions; INE drafted the manuscript; KCA and UEO reviewed the manuscript; KCA, UEO and COE supervised the study.

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