Prevalence and factors associated with bacterial vaginosis in women in Brazil: a systematic review

Prevalência e fatores associados à vaginose bacteriana em mulheres no Brasil: uma revisão sistemática

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ABSTRACT

Introduction: Bacterial vaginosis is characterized by the imbalance of the vaginal flora, with decrease in *Lactobacillus* and increase in other bacteria. **Objective**: To investigate the prevalence and factors associated with bacterial vaginosis. **Methods:** Systematic review based on the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses, filed in the International Prospective Register of Systematic Reviews. The research was conducted in the PubMed and Scopus databases in September 2021. After reading the titles and abstracts of 84 articles and the full text of 20 articles, 10 of them were included in the review. The articles were considered eligible if they investigated the prevalence of bacterial vaginosis and used Amsel's diagnostic criteria or Gram-stained bacterioscopy in women of reproductive age without comorbidities. The studies were evaluated by two investigators to establish reliability. The risk of bias and the quality of the selected studies were evaluated using the Joanna Briggs Institute tool. **Results:** The mean prevalence of bacterial vaginosis in the included studies was 25.4% (95%CI 24.0–26.8). In three population-based studies, the mean prevalence was 18.1% (95%CI 16.0–20.5); and in seven clinic-based studies, it was 27.2% (95%CI 24.6–29.9). The factors associated with bacterial vaginosis were the use of sex accessories (OR 2.4; 95%CI 1.1–4.9), marital status "single" (OR 1.4; 95%CI 1.1–1.8), partner infidelity (OR 1.5; 95%CI 1.2–1.9), abnormal vaginal secretion (OR 1.5; 95%CI 1.2–2.0), and the presence of trichomoniasis (OR 4.1; 95%CI 1.5–11.5). **Conclusion:** The prevalence of bacterial vaginosis was high, and the associated factors are linked to sexual behavior.
Keywords: Vaginosis, bacterial. Prevalence. Brazil. Systematic review. Sexual behavior.

RESUMO

Introdução: A vaginose bacteriana caracteriza-se pelo desequilíbrio da flora vaginal, com diminuição dos *Lactobacillus* e aumento de outras bactérias. **Objetivo:** Investigar a prevalência e os fatores associados à vaginose bacteriana. **Métodos:** Revisão sistemática baseada nas diretrizes do *Preferred Reporting Items for Systematic Reviews and Meta-Analyses*, protocolado no *International Prospective Register of Systematic Reviews*. A pesquisa foi realizada nas bases de dados da PubMed e da Scopus, em setembro de 2021. Após a leitura dos títulos e dos resumos de 84 artigos e do texto completo de 20 artigos, dez foram incluídos na revisão. Os trabalhos foram considerados elegíveis quando investigaram a prevalência de vaginose bacteriana e utilizaram os critérios diagnósticos de Amsel ou a bacterioscopia corada pelo Gram em mulheres em idade reprodutiva e sem comorbidades. Os estudos foram avaliados por duas pesquisadoras para estabelecer a confiabilidade. O risco de viés e a qualidade das pesquisas selecionadas foram avaliados pela ferramenta do Joanna Briggs Institute. **Resultados:** A prevalência média de vaginose bacteriana nos trabalhos incluídos foi de 25,4% (intervalo de confiança — IC95% 24,0–26,8). Em três estudos de base populacional, a prevalência média foi de 18,1% (IC95% 16,0–20,5); e, em sete estudos de base clínica, a prevalência média foi de 27,2% (IC95% 24,6–29,9). Os fatores associados à vaginose bacteriana foram o uso de acessórios sexuais (*odds ratio* —OR 2,4; IC95% 1,1–4,9), estado civil "solteira" (OR 1,4; IC95% 1,1–1,8), infidelidade do parceiro (OR 1,5; IC95% 1,2–1,9), secreção vaginal anormal (OR 1,5; IC95% 1,2–2,0) e presença de tricomoníase (OR 4,1; IC95% 1,5–11,5). **Conclusão:** A prevalência de vaginose bacteriana foi elevada e os fatores associados estão ligados ao comportamento sexual.
Palavras-chave: Vaginose bacteriana. Prevalência. Brasil. Revisão sistemática. Comportamento sexual.

INTRODUCTION

Bacterial vaginosis (BV) is characterized by the inversion of the vaginal flora with a decrease in *Lactobacillus* sp. and the proliferation of other anaerobic bacteria, such as *Gardnerella vaginalis*, *Prevotella* sp., *Atopobium vaginae*, *Mobiluncus* sp., and *Mycoplasma hominis*[1]. The cause of this dysbiosis is unknown, and this condition is not considered to be sexually transmitted[2]. The importance of *Lactobacillus* in vaginal homeostasis is due to the metabolism of glycogen, with the production of lactic acid, and consequent maintenance of vaginal pH at levels less than or equal to 4.5, an unfavorable situation for the disproportionate development of anaerobic bacteria[3].

The imbalance in the vaginal flora, with excessive proliferation of anaerobic bacteria, may cause the appearance of gray-white vaginal secretion with a foul odor, symptoms that cause intense discomfort[4]. Studies show that more than 50% of women with BV have abnormal vaginal secretions with a foul odor, which can lead to an imbalance in their physical, mental and sexual well-being[5]. BV is considered the most common cause of abnormal vaginal secretion[6].

In addition to its high prevalence, BV is associated with relevant negative implications for women's health, including the unpleasant symptoms that influence their physical well-being, self-esteem and sexual life[4]. There is further evidence that suggests that BV may be associated with obstetric and gynecological complications, such as preterm labor, pelvic inflammatory disease, ectopic pregnancy, and chronic pelvic pain, aside from postoperative complications and increased risk of transmission of sexually transmitted infections (STI), like human immunodeficiency virus (HIV)[7,8].

The gold standard for diagnosing BV consists of reading Gram-stained vaginal smear with or without the Nugent score[2]. This method involves the identification and quantification of lactobacilli, as well as the species of *Gardnerella vaginalis*, *Mobiluncus* and *Bacteroides*, and requires a laboratory with experience to identify these bacteria[2,9,10]. Besides, the use of Amsel's clinical

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criteria is considered equally effective in the diagnosis of BV, being considered positive for BV when three of four clinical criteria are met[2,10,11].

OBJECTIVE

To investigate the prevalence and factors associated with BV.

METHODS

Search strategy

A systematic review was conducted through the analysis of articles that addressed the prevalence and factors associated with BV in Brazilian women, according to the guidelines of the PRISMA[12]. The project was registered in the PROSPERO (CRD42020135522). The bibliographic research was carried out in the PubMed and Scopus databases in September 2021. Original articles published in Portuguese, English and Spanish in the period from 2001 to 2021 were included. The search strategies included the following terms in Health Sciences Descriptors (DeCS): "bacterial vaginosis", "prevalence", "Brazil", "systematic review", "sexual behavior", with the Boolean operator "And".

Eligibility criteria

The articles were considered eligible if they met the inclusion criteria that: (i) investigated the prevalence of BV in Brazilian women; (ii) used Amsel's clinical diagnostic criteria and/or Gram-stained bacterioscopy; (iii) included women of reproductive age without comorbidities; (iv) presented a clearly described methodology; and (v) showed consistency between the proposed methodology and the results presented.

Case-control studies, literature reviews (with or without meta-analysis), case studies, comments, editorials, and repeated studies were excluded.

Data extraction

Data were extracted such as the first author, year, place and region of publication, number of participants, their age, prevalence in each population studied, diagnostic methods, and factors associated with BV, using their respective confidence intervals (95%CI), the most common statistical technique for showing the degree of estimation uncertainty.

Data analysis

The studies were evaluated by two investigators to establish reliability[13]. The data were synthesized in tables and analyzed in a descriptive way.

The mean prevalence of BV in Brazil was calculated by evaluating the percentage with its respective 95%CI, in the OpenEpi software, version 3.0.

The risk of bias and the quality of the selected studies were evaluated using the Joanna Briggs Institute (JBI) critical appraisal tools for prevalence and incidence studies in systematic reviews[14]. Nine methodological domains were evaluated: (P1) adequate sample structure; (P2) appropriate recruitment method; (P3) adequate sample size; (P4) description of data collection location; (P5) description of participants and scenario; (P6) validity of diagnostic methods; (P7) standard and reliable use of diagnostic methods; (P8) appropriate statistical analysis; and (P9) adequate response rate.

Each item was evaluated through the answers "Yes", "No", "Uncertain" and "Not Applicable". Studies with a sum of "Yes" answers ≥7 were considered of *high* quality and low risk of bias; those with a score of 5 and 6 were considered of *medium* quality and moderate risk of bias; and those ≤4 were considered of *low* quality and high risk of bias.

RESULTS

Selection of articles

The electronic search resulted in 84 articles, 56 of which were present in the PubMed database and 28 in Scopus. Among them, 9 were published in Portuguese and 75 in English. After reading the titles and abstracts of the articles, 20 studies that investigated the prevalence of BV in the Brazilian population of reproductive age without comorbidities, using Amsel's clinical criteria or Gram-stained bacterioscopy, were selected.

Thereafter, the 20 complete articles were carefully read, which resulted in the exclusion of 10. In total, these 10 articles were eligible for the systematic review. **Figure 1** presents a flowchart with the description of the process of selection and exclusion of studies, elaborated in accordance with the PRISMA guidelines[12].

Risk of bias and quality assessment of the selected studies

Ten studies were evaluated using the JBI tool[14]. The score showed that nine of them had a low risk of bias and high quality[15-23] and one had a moderate risk of bias and medium quality.[24] **(Table 1)**.

Prevalence of bacterial vaginosis

The prevalence of BV in studies conducted in Brazil, published between 2001 and 2021, was evaluated in ten cross-sectional studies, three of which were population-based[15,18,20]. The other seven were conducted in health services[16,17,19,21-24]. The largest number of publications was identified in the Southeast region (six studies), followed by the Northeast region (three studies) and the North region (one study) **(Table 2)**.

The method used for the diagnosis of BV was Gram staining in seven studies, four of them according to the Nugent criteria[16,17,21,24]. Three did not specify the criteria used[20,22,23]. In three studies, the diagnostic method was used according to Amsel's clinical criteria[15,18,19].

The number of participants included was 3,765 sexually active women, aged 10–63 years old, most of them with low income and low education. The mean prevalence of BV in the included studies was 25.4% (95%CI 24.0–26.8).

Three population-based studies were included in this review, one of them conducted in the North region and two in the Northeast

region. One of them was conducted in the mining village of Serra Pelada, in the state of Pará; another one in the municipality of Pacotti, in the state of Ceará; and the last one in four rural and urban communities in the municipality of União dos Palmares, in the state of Alagoas[15,18,20]. The number of participants included in these three studies was 1,142; their ages ranged from 15 to 63 years old. The prevalence in the three studies was of 18.7% (95%CI 13.4–24.0),

20% (95%CI 16.9–23.6), and 15.3% (95%CI 11.8–19.4), respectively; the mean prevalence was 18.1% (95%CI 16.0–20.5)[15,18,20].

One of the studies included in this review was conducted in a screening health service for cervical cancer, in the Southeast region of Brazil, in the city of Botucatu, São Paulo[21]. A total of 1,519 participants, aged 15–44 years old, were included. In this sample, the prevalence of BV was of 30% (95%CI 27.8–32.4)[21].
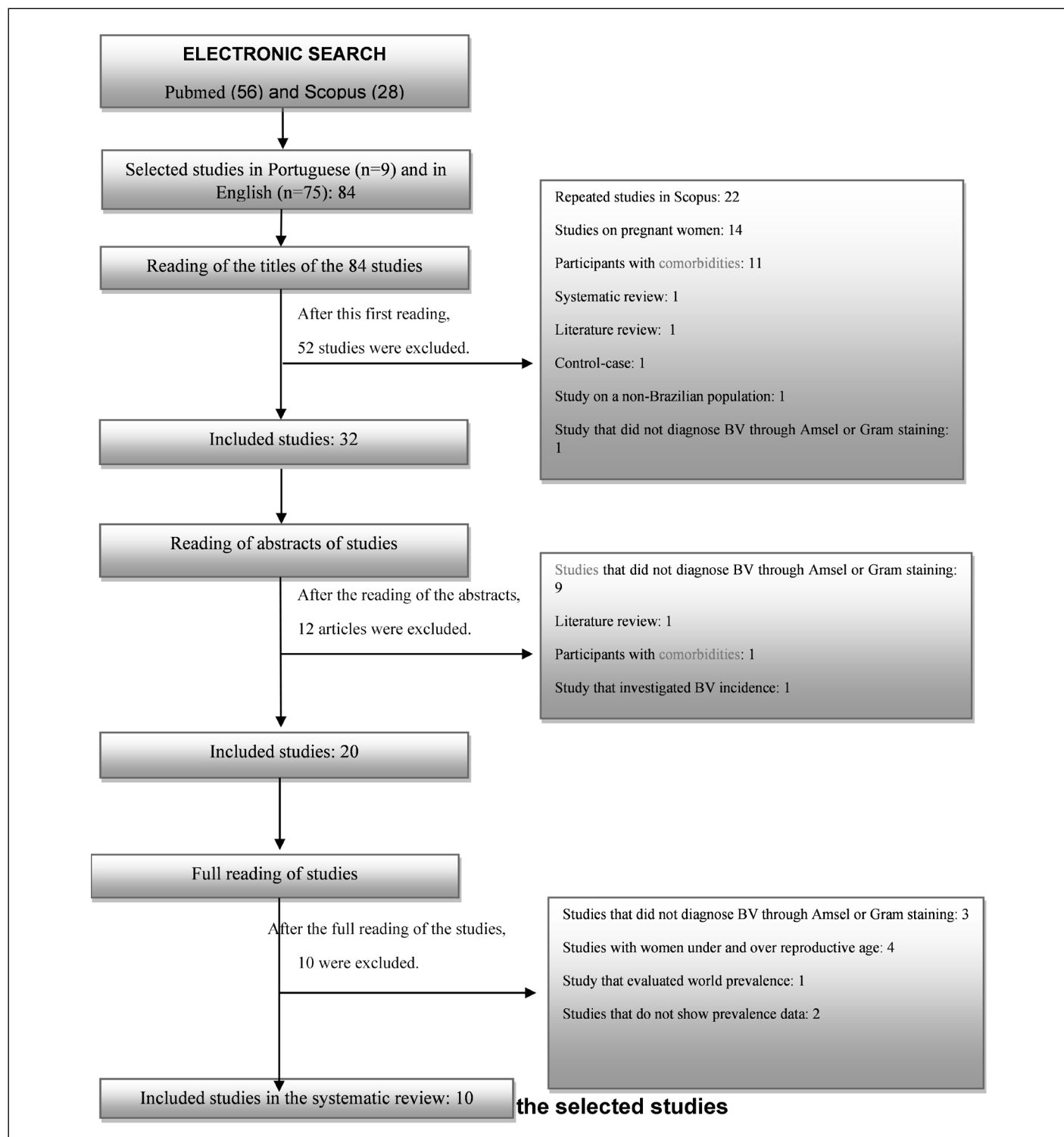

Figure 1. Description of the selection process of studies included in the systematic review.

Table 1. Risk of bias and quality assessment of the selected studies.

Studies	Questions									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	N
De Lima Soares et al.[15]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Ferraz do Lago et al.[16]	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	8
Giraldo et al.[17]	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	8
Oliveira et al.[18]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Barcelos et al.[19]	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	8
Miranda et al.[20]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Marconi et al.[21]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Amaral et al.[22]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Ignácio et al.[23]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Mascarenhas et al.[24]	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	6

P1: adequate sample structure; P2: appropriate recruitment method; P3: adequate sample size; P4: description of data collection location; P5: description of participants and scenario; P6: validity of diagnostic methods; P7: standard and reliable use of diagnostic methods; P8: appropriate statistical analysis; P9: adequate response rate.

Table 2. Prevalence and factors associated with bacterial vaginosis in Brazilian women (2001–2021).

Author Region	Study design (data collection location)	Number and characteristics of participants	Age (years old) (mean/median)	Diagnostic Method	Prevalence% (95%CI)	Associated factors Adjusted odds ratio (95%CI)
De Lima Soares et al.[15] Northeast	Population-based cross-sectional (rural communities)	341 Mostly low-schooling and low-income levels	15–63 Median: 34	Amsel***	15.3 (11.8–19.4)	–
Ferraz do Lago et al.[16] Southeast	Clinic-based cross-sectional	223 Mostly low-schooling and low-income levels	Mean: 36.4	Gram (Nugent)*	19.7 (15.0–25.4)	–
Giraldo et al.[17] Southeast and Northeast	Clinic-based cross-sectional	177 Mostly low-schooling and low-income levels	18–57 Median: 33	Gram (Nugent)*	18.6 (13.6–25.0)	–
Oliveira et al.[18] Northeast	Population-based cross-sectional (urban and rural centers)	592 Mostly low-schooling and low-income levels	23–39 Median: 31	Amsel***	20.0 (16.9–23.6)	–
Barcelos et al.[19] Southeast	Clinic-based cross-sectional	299 Mostly low-schooling levels	15–49 Median: 30	Amsel***	21.3 (16.7–25.9)	–
Miranda et al.[20] North	Population-based cross-sectional (mining village)	209 Mostly low-schooling and low-income levels	Mean: 38	Gram**	18.7 (13.4–24.0)	–
Marconi et al.[21] Southeast	Clinic-based cross-sectional (cervical uterine cancer screening service)	1,519 Mostly with low-schooling and low-income levels	14–54 Median: 33	Gram (Nugent)*	30.0 (27.8–32.4)	Single: 1.4 (1.1–1.8) Infidelity: 1.5 (1.2–1.9) Previous abnormal vaginal secretion: 1.5 (1.2–2.0) Trichomoniasis: 4.1 (1.5–11.5)
Amaral et al.[22] Southeast	Clinic-based cross-sectional (prostitution area)	155 Sex workers	18–27 Mean: 25.5	Gram**	51.0 (43.1–58.7)	–
Ignácio et al.[23] Southeast	Clinic-based cross-sectional	150 women who have sex with women. Higher education	Equal or superior to 18	Gram**	36.0 (28.7–43.9)	Use of sex accessories: 2.4 (1.1–4.9)
Mascarenhas et al.[24] Northeast	Clinic-based cross-sectional	100 Sexually active teenagers, mostly with low-income levels	10–19 Mean: 16.6	Gram (Nugent)*	20.0 (12.0–28.0)	–

*Gram-stained vaginal smear, according to Nugent's criteria; **Gram-stained vaginal smear with no information on the criterion used; ***Amsel's clinical criteria.

The other six studies were conducted in health services, five of them in the Southeast region and one in the Northeast region. The number of participants of these six studies amounts to 1,104, aged 10–57 years old, and the prevalence levels were of, respectively, 18.6% (95%CI 13.6–25.0), 19.7% (95%CI 15.0–25.4), 20% (95%CI 12.0–28.0), 21.3% (95%CI 16.7–25.9), 36% (95%CI 28,7–43.9), and 51% (95%CI 43.1–58.7), with a mean prevalence of 27.2% (95%CI 24.6–29.9)[16,17,19,22-24].

Three of the six studies conducted in health services included a sample of 150 women who have sex with women, 155 sex workers and 100 adolescents[22-24]. In these three studies, the prevalence of BV was of, respectively, 36% (95%CI 28.7–43.9), 51% (95%CI 43.1–58.7), and 20% (95%CI 12.0–28.0)[22-24].

The following factors associated with BV, in a multivariate analysis, were identified in two studies:
1. use of sex accessories, with OR 2.37 (95%CI 1.1–4.9);
2. marital status "single", OR 1.4 (95%CI 1.1–1.8);
3. partner infidelity, OR 1.5 (95%CI 1.2–1.9);
4. abnormal vaginal secretion, OR 1.5 (95%CI 1.2–2.0); and
5. presence of trichomoniasis, OR 4.1 (95%CI 1.5–11.5), as shown in Table 2[21,23].

DISCUSSION

The large number of sexually active women included, ranging from adolescence to old age, and most of whom with low-income and low-schooling levels, probably represents the profile of the Brazilian population. In addition, the most frequently used diagnostic method was vaginal smear Gram staining, which is considered the gold standard for the diagnosis of BV, followed by Amsel's clinical criteria[2,11]. None of the studies evaluated BV through cytological examination, which is considered of low specificity and low sensitivity for its diagnosis[2]. These data point to the quality of the sample representation and the quality of the laboratory evaluation to establish the prevalence. Thus, the prevalence of BV in the included studies ranged from 15.3% (95%CI 11.8–19.4) to 51.0% (95%CI 43.1–58.7), with a mean prevalence of 25.4% (95%CI 24.0–26.8)[15,22].

The three population-based studies included, in which 1,142 asymptomatic women were implied, were conducted in urban and rural communities, distant from health services[15,18,20]. In these studies, the prevalence was also high and ranged from 15.3% (95%CI 11.8–19.4) to 18.7% (95%CI 13.4–24.0)[15,20]. The overlap of the 95%CI in these three studies shows that there is no statistically significant difference in prevalence. Regarding the population-based diagnosis of BV, there is evidence that most women with this diagnosis were asymptomatic[2,25]. It is important to note that the treatment of BV is only indicated to relieve symptoms[2,10]. In spite of that, evidence in cross-sectional studies associated this condition with gynecological and obstetric complications and increased transmission of STIs[7,8]. These associations can be better investigated in a cohort study to define the cause. Accordingly, based on these conduct guidelines and on the design of currently available studies, BV should not be screened, since treatment is not indicated for asymptomatic patients[2,10].

In the seven studies conducted in health services, where the presence of gynecological symptoms was implied, in a sample of 2,623 women, the prevalence ranged from 18.6% (95%CI 13.6–25.0) to 51% (95%CI 43.1–58.7)[16,17,19,21-24].

The highest prevalence was found in a study conducted with sex workers, in a prostitution area, with a prevalence of 51% (95%CI 43.1–58.7), and in another study conducted with women who have sex with women, with a prevalence of 36% (95%CI 28.7–43.9)[22,23]. This high prevalence among sex workers is noteworthy, once BV is not considered a STI[2,10]. Besides that, this prevalence is worrisome in this population, since there is evidence that BV is associated with an increase in the transmissibility of HIV infection and other STIs[2,10,25]. An equally intriguing fact, as it is not considered to be of sexual transmission, is the high level of concomitant BV among women who have sex with women[26]. These data point once again to the need for studies with adequate designs to assess the cause-and-effect relationship of BV with STI and of the possibility of microbiome sharing among sexual partners.

Among clinic-based studies, the third place in prevalence (30%), surprisingly occurred in a screening service for cervical cancer with 1,519 participants[21]. In these services, most participants are also expected to be asymptomatic and, therefore, would not require treatment[2,25]. In other clinic-based studies, the prevalence was similar, as shown by the overlap of the 95%CI, ranging from 18.6% (95%CI 13.6–25.0) to 21.3% (95%CI 16.7–25.9)[16,17,19,24].

The wide variation in the prevalence of BV found in this review reflects the heterogeneity of the samples evaluated, especially in clinic-based studies. The subjectivity of the two diagnostic methods used for BV in this review must also be considered. The methods that used both the evaluation of the vaginal flora in Gram-stained vaginal smears and Amsel's clinical criteria have inherent subjectivity in clinical and microscopic evaluation[9,11].

Only two of the ten clinic-based studies included in this review evaluated factors associated with BV[21,23]. One of them conducted on a sample of 150 women who have sex with women identified the use of sex accessories as a factor[23]. Another one conducted in a screening service for cervical cancer, with a sample of 1,519 participants, identified the following association: marital status "single", partner infidelity, presence of abnormal vaginal secretion, and presence of trichomoniasis[21]. All these factors are directly or indirectly connected to sexual activity, although the condition is not considered to be sexually transmitted[2,10]. This finding, present in another study, indicates the need for better assessment of the factors associated with this condition and the role of sexual partners in the development and recurrence of BV[4].

Strengths

This review presents:
1. research in two large databases in health sciences;
2. search period of 20 years, without language restriction;
3. the articles included were full texts, published in peer-reviewed journals, with no reports of conflicts of interest and approved by ethics committees; and
4. the risk of bias and the quality of studies were assessed through the JBI critical appraisal tools[14].

Limitations

The limitations could be considered as

1. the inclusion of only ten articles, which three of them could be classified as population-based and were conducted in populations distant from urban centers; and
2. in most studies, the sample was smaller than 300 participants, with great variability regarding age groups, habits and place of residence.

CONCLUSION

This study showed that the prevalence of BV in Brazilian women treated in health and population-based units was high and that the diagnosis of this condition can benefit this population, preventing gynecological and obstetric complications and reducing the risks of STI. Thus, the findings of the present investigation support the assumption that the factors associated with BV are directly or indirectly linked to sexual activity, although the condition is not considered to be sexually transmitted.

Approval by the Human Research Ethics Committee

The project was registered in the International Prospective Registry of Systematic Reviews (PROSPERO) (CRD42020135522).

Participation of each author

KCC: Conceptualization, Data curation, Writing – original draft, Writing – review & editing. RRFA: Conceptualization, Data curation, Writing – original draft, Writing – review & editing. VAS: Conceptualization, Data curation, Writing – original draft, Writing – review & editing.

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Conflicts of interest

The authors declare no conflicts of interest.

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