

# Vaginal pH Value in Common Vaginitis

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In modern society, 75% of all women worldwide have had vaginitis at least once in their lives. The vagina has a dynamic microbial ecosystem with varying vaginal pH levels. An imbalance in that ecosystem can alter the vaginal pH and tip the scale to the point of causing issues, such as vaginitis, that require medical attention. Although vaginitis is not an incurable disease, it causes discomfort and pain that disrupt women's daily lives. The most common causes of vaginitis include bacterial vaginosis, trichomoniasis, and vulvovaginal candidiasis. In this review, we discuss the causes, diagnostic methods, and symptoms of different types of vaginitis, the relationship of vaginitis to the prevalence of other diseases, issues associated with recurrent vaginitis and the immune system, and a variety of effective available treatments.

vaginal pH

vaginitis

diagnosis

treatment

## 1. Introduction

The vagina serves as an outside-communicating channel with the functions of draining menstruation and childbirth delivery. The vagina normally has unique flora that sustains the internal physical and chemical environment. The presence of normal flora relies on maintenance of various components of the ecosystem, which is in dynamic equilibrium [\[1\]](#). Based on several published articles, the normal vaginal pH for women of childbearing age ranges from 3.8 to 5.0, which is moderately acidic [\[2\]](#)[\[3\]](#). The normal vagina is covered by a thin layer of transparent liquid, commonly known as vaginal fluid. Many factors may lead to changes or imbalances in the vaginal pH value, including vaginal infections, aging, sexual activity, and vaginal douching [\[4\]](#).

The common vaginal microbiome, the *Lactobacilli* species, can produce acidic pH and bacteriocins to kill other bacteria in the vagina. *Lactobacilli* can produce an acidic environment in the vagina, which is designed to protect women from sexually transmitted pathogens and opportunistic infections [\[5\]](#). If these normal flora such as *Lactobacilli* are absent or significantly reduced, the vaginal ecosystem will become imbalanced, and other microorganism or bacteria inside vagina may become overgrown, leading to vaginitis. Moreover, Ravel et al. first identified the five community state types (CSTs) in 2011 [\[6\]](#), providing a powerful scheme to classify the status of the human vaginal microbial community (HVMC). These communities are divided into five groups: four groups are dominated by *Lactobacillus iners*, *L. crispatus*, *L. gasseri*, or *L. jensenii*, and the fifth has a lower proportion of lactic acid bacteria and a higher proportion of strictly anaerobic organisms.

Vaginitis has different types, including bacterial vaginosis (BV), vaginal candidiasis, trichomoniasis, and aerobic vaginitis [\[7\]](#). This review focuses on the first three common types of vaginitis. Under the current standard, the

diagnosis of vaginitis depends on criteria based on several clinical presentations. For example, the diagnosis of bacterial vaginosis has been based on Amsel Criteria in clinical [1] routine since 1983. Following the Amsel Criteria, bacterial vaginosis is diagnosed by the presence of three out of four conditions, including homogenously milky vaginal discharge, vaginal pH over 4.5, positive KOH whiff test, and 20% at least of clue cells under wet-mount test by microscope [8]. The Nugent Score is a scoring system that calculates the relative number of bacterial morphologies under Gram-stained vaginal discharge smears to diagnose bacterial vaginosis [9]. For both abovementioned diagnostic criteria, the vaginal fluid pH is a useful and unique marker for vaginitis. Abnormal pH values increase the possibility of vaginitis, and the measurement of vaginal pH has been used for initial screening [10]. From previous studies, a vaginal fluid pH value of 4–4.5 or less signifies the absence of vaginitis, whereas a pH value of more than 4.5 denotes vaginitis and bacterial vaginosis (BV) [11]. However, with a trichomonas vaginalis infection, the pH value may be increased to 6.5 or more [12].

There are various signs and symptoms of vaginitis that hint at different types of vaginitis with further corresponding treatments in clinical routine. In previous research, a combination test of vaginal fluid pH value with symptomology was shown to diagnostic sensitivity [13]. **Table 1** and Table 2 demonstrate the associated symptoms, signs, risk factors, and treatments of different types of vaginitis [12][13][14][15][16][17]. From this article, we review the relationship among vaginitis, vaginal fluid pH, and the associated immune system. In the closing discussion, we also review the use of commercially available vaginal pH testing products. These vaginal fluid pH test products can serve as self-test tools used at home by patients themselves, especially those with suspected symptoms of vaginitis, such as unusual odor, itching, burning pain, or abnormal vaginal fluid. We hope that this study can increase women’s attention to vaginitis and encourage women to seek treatment as early as possible.

**Table 1.** Symptoms and signs of vaginitis (Information from [12][13][14][15][16][17]).

Diagnosis	Etiology	Symptoms	Signs	Risks	pH Value
<b>Bacterial vaginosis</b>	Anaerobic bacteria (Prevotella, Mobiluncus, Gardnerella vaginalis, Ureaplasma, Mycoplasma)	Fishy odor; malodorous; homogenous; clear, white, or gray discharge that may worsen after intercourse; pelvic discomfort may be present.	No inflammation.	Increased risk of HIV, gonorrhea, chlamydia, and herpes infections.	greater than 4.5
<b>Vulvovaginal candidiasis</b>	Candida albicans, Candida krusei, Candida glabrata	No odor; white, thick, cheesy, or curdy discharge; vulvar itching or burning.	Signs of inflammation; Vulvar erythema and edema.	vulvodynia	4.0
<b>Trichomoniasis</b>	Trichomonas vaginalis	Green or yellow, frothy discharge; foul odor; pain with sexual intercourse,	Signs of inflammation, “strawberry cervix”;	Increased risk of HIV infection Increased risk	5.0–6.0

**REFERENCES**

Diagnosis	Etiology	Symptoms	Signs	Risks	pH Value
		vaginal soreness, dysuria.	Vestibular erythema may be present.	of preterm labor. Should be screened for other sexually transmitted infections.	n.  re- and

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Table 2. Treatment for the most common vaginitis (Information from [13, 14, 15, 18]).

	Treatment		
	Initial Regimen	Alternative Regimen	
<b>Bacterial vaginosis</b>	Metronidazole (Flagyl), 500 mg orally twice daily for seven days Or Metronidazole 0.75% gel (Metrogel), one full applicator (5 g) intravaginally daily for five days Or Clindamycin 2% cream, one full applicator (5 g) intravaginally at bedtime for seven days	Tinidazole (Tindamax), 2 g orally once daily for two days or Tinidazole, 1 g orally once daily for five days Or Clindamycin, 300 mg orally twice daily for seven days or Clindamycin (Cleocin Ovules), 100 mg intra-vaginally at bedtime for three days	H: Why  Gorle, Natl.  initis:
<b>Vulvovaginal candidiasis</b>	Topical azole therapy or Fluconazole (Diflucan), 150 mg orally, single dose	Medical-grade honey (MGH)	cific  83, 74,
<b>Trichomoniasis</b>	Metronidazole, 2 g orally, single or divided dose on the same day Or Tinidazole, 2 g orally, single dose	Metronidazole, 500 mg orally twice daily for seven days	

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vaginitis [33]. For women with a normal, active menstruation cycle, the vaginal pH is typically between 3.8 and 5.0 [3]. Abnormal menstrual cycles are a common feature of puberty. Their existence is related to an increased risk of abnormal pH. The subsequently relatively high vaginal pH may also result in susceptibility to BV [34].

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Another product on the market, the Biosynex Exacto 3 vaginal infection test [37], has demonstrated reliability and accuracy (90%). It is easy to use, can produce immediate results, and is suitable for the preliminary diagnosis of vaginal infection. This product provides straightforward vaginal contact sampling and presents rapid, easy-to-interpret, and simple color-coded results. There are several other commercially available vaginitis self-diagnostic devices summarized in **Table 3**.

**Table 3.** Summary of commercially available vaginal self-test products.

Brand	Hygeia Touch	Biosynex	FloriSense	Monistat
Appearance				
Accuracy	88%	90%	92%	92%
Test/pack	1	3	2	2
Advantage	The double-layer structure is optimized	Because there are 3 tests in each box,	Reliable accuracy is over 90% and	Effective for the diagnosis of yeast-

Brand	Hygeia Touch	Biosynex	FloriSense	Monistat
	for product safety and ease of use.	there is an advantage in quantity.	product is easy to read.	based vaginal infections

Classic basic design ensures that the depth of insertion is not overly deep. The use of flexible, medical-grade plastic makes it comfortable and safe for use. The appropriate use of these devices allows patients to monitor the disease course and select the correct over-the-counter (OTC) antifungal drugs, which the FDA approved in 1990. These products can be used by patients themselves, enhance the caution of vaginal health, and facilitate the maintenance of vaginal pH and overall health.