The Effects of Feminine Hygiene and Beauty Products on Vaginal Health

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Abstract

The female reproductive system is a rather sensitive region compared to other parts of the body, and the vagina itself is colonized by lactobacilli, which regulate the pH and overall vaginal ecosystem. The balance maintained by these microbes is easily disrupted, which can lead to vaginal infection due to pathogenic microbes out-competing beneficial ones. The purpose of this research was to discover if the use of feminine hygiene products and beauty products leads to the increase in vaginal infections and if these infections arise solely based on the vaginal ecosystem itself or external factors. A broad range of scientific and medical literature was examined for information on the correlation between product use and likelihood of infection, as well as risks associated with the ingredients in products used. A list of ingredients from some common products was also gathered and compared to information found in the literature. It was found that with only some minor exceptions, there is a strong correlation between the use of several different products and the increase in vaginal infection, which can then lead to more serious complications. There are alternatives that can be used in place of harmful products, but an overall increase in available information and improvement in education seems to be a potential solution to these problems.

Introduction: The Vaginal Ecosystem

The human vagina is a very sensitive region of epithelial tissue. This area is more absorbent than the outward skin covering the rest of the body, and has a self-cleaning and lubricating function in which it secretes a mucous that washes away harmful microbes and
protects the vagina against them.\textsuperscript{2} The epithelial cells lining the vaginal walls have an important role in estrogen signaling,\textsuperscript{2} which plays a part in regulating the pH of the environment.\textsuperscript{3} The vagina is inhabited by a diverse ecosystem of microorganisms, hydrogen peroxide-producing lactobacilli, specifically \textit{Lactobacillus acidophilus}, being the most prevalent.\textsuperscript{4, 5, 6} Microbes in this environment are mostly anaerobic,\textsuperscript{2} but there are also aerobic, facultative anaerobic, and oxygen-tolerant anaerobic species present.\textsuperscript{7} Lactobacilli create an acidic environment in the vagina, which is inhospitable for some other types of organisms, thus protecting the vagina from these potentially-pathogenic organisms. Lactobacilli also protect the environment through their production of hydrogen peroxide.\textsuperscript{1, 5, 6, 7} Changes in vaginal pH affect the ability of bacteria to bind to eukaryotic cells in the vagina, usually with a raised pH increasing the ability to bind.\textsuperscript{7} Lactobacilli lower the pH of the environment they are in during their logarithmic growth phase. In laboratory trials, the microbes acidified their growth medium to a pH of about 3.2-4.8, which is comparable to the healthy vaginal pH range from 3.6-4.5.\textsuperscript{1, 3} There are approximately $10^8$-$10^9$ lactobacilli organisms in a healthy vagina, producing this acidic environment.\textsuperscript{3} The pH of the vaginal environment is always fluctuating based on the phase in the female reproductive life. For example, the vagina becomes more acidic during pregnancy,\textsuperscript{7} and when a woman is reaching menopause, the overall pH begins to rise to a more alkaline environment.\textsuperscript{1}

\textbf{Introduction to the Problem}

Because of the ever changing environmental conditions, the pH balance, as well as types of microorganisms, can easily be altered. A pH of approximately 4 generally keeps the vagina in a healthy state. If the pH rises above 4.5, problems like vaginal infections can arise.\textsuperscript{1, 3} An external example of a pH-changing factor could be the introduction of semen
into the vaginal environment. The semen neutralizes the normal acidity, and it won’t be fully restored until hours later, as the vagina re-acidifies at about 0.5 pH units per hour.\textsuperscript{3} However, the main reason for a pH shift is a change in the balance of the types of microbes present in the vagina. The prevalent lactobacilli in the vagina can be overgrown by more pathogenic microbes that are always present in the vagina, but normally in small numbers. When this balance is shifted, the more harmful microbes then have the potential to cause infection.\textsuperscript{3,7}

Common vaginal infections include bacterial vaginosis (BV), vulvovaginal candidiasis (VVC), \textit{Trichomoniasis vaginalis} infection, urinary tract infections, and cytolytic vaginosis or Döderlein cytolysis. Many of these infections can occur simultaneously; BV and \textit{T. vaginalis} infections are often seen together, and some infections can result in other secondary infections. Additionally, if BV is treated with metronidazole, VVC can result.\textsuperscript{8} Döderlein cytolysis also occurs in 12.6\% of women who already have bacterial vaginosis, and this number can rise to 25\% when more mild cases are included.\textsuperscript{7} Candidiasis is associated with a thick, white, curd-like discharge visible on the vaginal wall, itching, soreness, inflammation and occasionally lesions on different areas of the vulva.\textsuperscript{9} Bacterial vaginosis commonly brings grey or yellow discharge with a fishy odor.\textsuperscript{1} Although several organisms causing these infections are found in low numbers in the healthy vagina, some can also originate from the gastrointestinal tract.\textsuperscript{1,7,9} Many of these infections often cause an inflammatory response and increase the number of leukocytes in the vaginal fluid. Exceptions are BV, which isn’t normally associated with inflammation, and Döderlein cytolysis that results in a lower number of leukocytes in the tissue.\textsuperscript{7} Bacterial vaginosis, parasites like \textit{T. vaginalis}, and yeast infections affect 10-75\% of reproductive-aged women,
and many of these infections are recurrent. Imbalances in healthy vaginal flora that cause infections can also lead to an increased susceptibility to sexually transmitted infections (STIs).

The numerous infections and conditions that are common in the female reproductive system do not arise independently or solely based on changes in the vaginal ecosystem itself. Many external factors like products used and personal practices play a part in increasing the potential of infection.

**Feminine Washes and Douches**

There seems to be a significant correlation between use of feminine washes and douches and the presence of a vaginal infection. In a 1996 study, scented and antiseptic soap use was more common in women with symptoms of BV, and the infection was three times more common in women who used the products on the vulvar as well as vaginal regions. Bacterial vaginosis was four times more frequent in women who used products with antiseptic properties on the vulvar region, although the product may have been used to help improve already-existing symptoms, but remained unclear in the study. Another study found that 94% of women who participated reported having washed vaginally within the past week. There is some substantiation that douches and personal lubricants are less irritating than some feminine washes because the former products don’t contain pharmacological or surfactant ingredients like ammonium lauryl sulfate and sodium lauryl sulfate, which have been found to be toxic to lymphocytes. Well-known brands Vagisil and Summer’s Eve carry products that contain derivatives of these damaging ingredients, as do some bath products like the popular bath bombs by Lush. Because of the potential damage and increased susceptibility to infections caused by these products, the
American Public Health Association strongly advises against their use unless there is a significant, medically-advised reason to do so.\textsuperscript{2} Studies have also been performed to measure the possible positive effects of these products, and some brands with milder ingredients have been shown to reduce the number of harmful pathogens, thus decreasing the potential of infection, without affecting beneficial lactobacilli.\textsuperscript{5, 6} Overall, washes and douches seem to do more harm than good for the vaginal ecosystem.

**Feminine Hygiene (Menstrual) Products**

Although menstrual products aren’t used deep into the vagina like some other products, they still have a great potential for damage. Allergic reactions and irritation, as well as contact dermatitis are common results of using menstrual pads. Tampons made from synthetic materials including plastics introduce an opportunity for absorption of the chemicals through the very permeable vaginal tissue.\textsuperscript{2} Four different synthetic ingredients were previously used in tampons; now only viscose rayon is permitted. The increase in cases of Toxic Shock Syndrome (TSS) in the early 1990s was the reason that three of the four synthetics are no longer used in manufacturing tampons, but TSS still occurs even with this ingredient change. However, there are no reported cases of Toxic Shock Syndrome in women with exclusive use of all-cotton products.\textsuperscript{2} In the presence of synthetic tampons, *Staphylococcus aureus*, a common bacterium in the vagina, has the ability to produce toxins which can harm the vaginal ecosystem and in turn, the woman. Dioxins have also been found in tampons, which are by-products of bleaching cotton and wood pulp, and minute exposure to these chemicals can accumulate in the body over the entire reproductive lifespan. Residues from eight different pesticides have also been found in one brand of all-cotton tampons. Regardless of synthetic versus all-cotton tampon use, the product still
creates tiny tears in the vaginal wall which provide openings for harmful chemicals or TSS toxins to enter the body.\textsuperscript{2}

**Soaps**

The use of different soaps for cleansing may seem harmless or even beneficial, but when brought into contact with sensitive areas such as the female reproductive system, these products can have very negative effects. In the same 1996 study, women's use of perfumed soaps and bubble baths on the vulvar mucosa made them twice as likely to have bacterial vaginosis, and all women in this study who used bubble bath on the vulvar region also used it vaginally. Additionally, most women participating used soap on the vulva and 25\% of them used it vaginally.\textsuperscript{4} In a different study on cosmetic products like emulsifiers, dispersants, and foaming agents, a carcinogen known as 1,4-dioxane was found in the majority of the materials tested.\textsuperscript{14} 1,4-dioxane is most commonly found in ammonium lauryl sulfate and sodium lauryl sulfate, again, common ingredients of feminine washes and bath bombs, which are cytotoxic to lymphocytes on their own, without the added dangers of carcinogens.\textsuperscript{10-13} The highest levels of the carcinogen were found in shampoo and skin cleanser.\textsuperscript{14} After encouragement by the Food and Drug Administration (FDA), manufacturing modifications were made that greatly decreased the levels of carcinogen content, but this trend did not persist, and has increased since 1993-1994.\textsuperscript{14} Surfactants used in soaps also have the potential to irritate skin and eyes,\textsuperscript{15} and would be expected to have the same effects when used on sensitive vaginal tissue.

**Medicated Products (Anti-Itch, Anti-Fungal, Spermicides, and Other Drugs)**

Over-the-counter or prescription products are often used to decrease inflammation from infection or as contraceptives, but the products may be more detrimental than
beneficial to vaginal health. The use of topically applied contraceptives was correlated with irritation of the vaginal epithelial surfaces because of the chemicals contained in them. Other issues arising from their use have included sloughing of epithelial cells, increased inflammation, increased permeability of the vaginal tissue, inflow of white blood cells, and dying off of lactobacilli. Spermicides, anti-itch products, and anti-fungal products remained the most irritating. Resorcinol, an active ingredient in two anti-itch creams, exhibited an inhibitory effect on lymphocyte mitogenesis. Steroid ingredients in anti-inflammatory products and anti-itch products as well as antibiotics seemed to predispose women to candidiasis. In some cases, women may have been using the products for infection symptom relief, but symptoms, in turn, were worsened. The beneficial properties of these products were some anti-bacterial and anti-fungal properties in douches, as well as periodic presumptive treatment (PPT) in the form of monthly doses of metronidazole and fluconazole showing a decrease in infection prevalence.

**Personal Practices and Sexual Practices**

Incidences of vaginal infections aren’t solely due to the products women use, but also how they personally care for themselves. Lack of personal hygiene and poor practices like squatting to urinate – not allowing proper drainage – improper wiping techniques, not drinking enough water, not urinating frequently enough or after sex, and not seeking medical attention for infection and relying on self-diagnosis seem to be some of the most significant factors in vaginal infections. Lack of knowledge on vaginal conditions, tight-fitting clothing trapping heat and moisture, and poor hygiene and infection in a male partner are also contributing factors. Bacterial vaginosis and other infections were more common in women with a history of STIs and with a higher level of sexual activity.
Additionally, viral vaginitis can be caused by herpes simplex which is spread by sexual contact. Oral sex and anal contact before sex also showed an increase in infection due to cross-contamination. Personal lubricants can also contain harmful chemicals like glycerin or glycerol that pull water out of epithelial cells and cause sloughing and damage, as well as toxicity from inactive ingredients. Silicone-based lubricants are shown to be the least harmful, and lubricants that lack harsh chemicals can lower infection rates. Increased resistance to vaginal infection and STIs may be achieved through use of a contraceptive sponge, condoms, and diaphragms. For example, condoms help maintain the vaginal flora by preventing contact with semen, which inhibits the immune response.

**Other Predispositions to Infection**

Factors other than products used and behavior influence a woman's likelihood of vaginal infection. One of the largest predispositions to future vaginal infections is having had similar infections in the past. Medical conditions like diabetes, malnutrition, genitourinary tuberculosis, leukemia, genital mycosis, X-ray exposure, use of antibiotics, and pregnancy also increase women's chances of repeat infection. Black women tend to have a higher vaginal pH and lower lactobacilli counts than white women, increasing their predisposition to infection. Other socioeconomic factors like lower education, lower income, unskilled laborers, and sex workers increase the likelihood of infection as well. Douching is also less common in the United Kingdom and Europe than in the United States, and less common in other races than black or Latina. The practice of douching is also commonly learned by women from their mothers, without knowledge of its negative effects. Some regions also place a higher importance on cleanliness and hygiene, sometimes leading to over-washing and use of harmful chemical-containing products. Finally,
women increasingly holding higher, more influential positions in government and scientific
research has led to better regulations on manufacturing as well as research on feminine
products – areas that may have been previously overlooked by men in the same positions.²

**More Serious Medical Outcomes**

Frequent vaginal infection in women can lead to having more serious medical
conditions and complications, sometimes unrelated to the reproductive system. Bacterial
vaginosis can contribute to pelvic inflammatory disease and premature delivery and low
birth weight in pregnant women.⁴ Exposure to carcinogens like 1,4-dioxane can have
effects as serious as cancer later in life.¹⁴ Other possible conditions increased by vaginal
infection include STIs such as HIV infection, toxic shock syndrome, dysplasia, cervical
neoplasia, human papilloma virus infection, miscarriages, ectopic pregnancies, cervical
cancer, and abortions in animals that also have the potential to occur in humans.², 5, 7, 9, 10
Another effect that is already taking place and impacting a wide array of people is
antimicrobial resistance. A specific example of this issue is the resistance of bacterial
vaginosis to the drug metronidazole, rendering the drug useless against an infection it
previously eliminated.⁸

**Possible Benefits of Some Products**

Although there are mostly negative effects from many products used vaginally, some
of these products do have benefits to the user. Some forms of contraceptives, douches,
washes, and medications have shown to decrease the occurrence of bacterial vaginosis and
other infections including sexually transmitted infections like HIV.⁴⁻⁸ These product
benefits could make the use of some products worthwhile if the benefit outweighs the
potential harm caused by them.
Healthy Alternatives and Prevention

In light of all of the harmful products for vaginal use, alternative products and practices may be a better option to decrease the risk of infection and further complications from those infections. Instead of harsh chemical-based washes and douches, vinegar and saline solutions have similar effects without negatively impacting vaginal flora. Different manufacturing processes in the past have led to reductions in carcinogenic by-products like 1,4-dioxane, and more attention to these areas once again could have the same benefit. Research has gone into using in vitro human tissue for product research, as opposed to previous, in vivo options. This innovation has led to a decrease in animal testing, more comparable results to real human tissue that the products are used on, and lower costs due to the process being faster and more effective on a large scale than previous processes. For personal and sexual care, more cleanliness and hygiene skills could be used by women and their partners, as well as looser-fitting clothing made of more breathable material, and all-cotton alternatives to synthetic menstrual products.

Education on Care

When considering all factors, education seems to be one of the most important ways of decreasing vaginal infection in women. The tradition of douching that has been passed down between generations of women is a large contributor to increased infection rates. Women and girls trust what their mothers have taught them and don’t question whether the practices are harmful. Women also need to be educated on the importance and sensitivity of the vagina and its connection to the rest of the body, as well as provided with more information available about possible vaginal conditions and their prevention. Less cultural stress should be placed on constant cleanliness and freshness to the point of over-
washing, as well as the taboo of discussing female reproductive health. Young girls as well as grown women need more education on proper hygienic techniques, encouragement to use contraceptives not only to prevent pregnancy but also infection, and the importance of seeking medical attention for any condition and less self-diagnosis. Lastly, more resources on exactly what is in the products women use and their potential risks should be made more widely available. Women shouldn’t need to suffer complications from poor practices and behavior or harmful product use simply because they weren’t exposed to reliable information.

**Conclusions**

In general, many factors play a role in keeping the vaginal environment healthy. Personal vaginal flora, products used, medical circumstances, and proper practices all have key influences on female health. Most products used in, on, or near the vagina have the potential to cause minor to serious harm, but some feminine products have benefits to the user as well. There are safer alternatives available to use instead of ones known to cause harm, and education of women and the public in general on physiology, products, practices, and resources is very lacking, yet seems to be one of the most important factors and most economical way to promote female reproductive health.
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