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# The Role of Lactic Acid to Maintain the Vaginal Health

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## *Abstract:*

*The human vagina is withdrawn by a range of microbes from a group of over 50 species. In women health, Lactobacilli are the most common, widespread, frequently numerically dominant micro-organisms and are relevant as a barrier of infection. The diversity of anaerobic and aerobic micro-organism consists of vaginal microbiota of healthy women and this microbiota can change composition rapidly, that are not fully clear. This microbiota leads to infection and to a state in which organisms with pathogenic potential co-exist with other common bacteria. In vaginal epithelium, the capacity of lactobacilli to adhere and compete for adhesion sites and in the impairment of colonization by pathogen capacity to produce antimicrobial compounds (hydrogen peroxide, lactic acid, bacteriocin-like substances) that are important. For some time, use of probiotics to populate the vagina and prevent or treat infection but it shows the efficacy including supplementation of antimicrobial treatment to improve cure rates and prevent recurrences. In this paper, discuss the role of lactic acid to maintain the vaginal health and use of probiotics.*

***Keywords:*** *Lactobacilli, Probiotics, Antimicrobial, Microbiota*

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## Introduction

The vagina is an organ that is an important to women as it is a source of pleasure but also a source of potential pain. It is open to the outside and located near the anus where the number of potentially pathogenic bacteria is large. In the body, needed for the protection system of vaginal to prevent the proliferation of pathogens. While this protection system already exists, in any case, vaginal is present in discomfort zone from frequent causes than for visiting gynecologists. This protection system is based on maintenance of acidic pH 3.5 to 4.5 where do not find the favorable conditions to proliferate by common and potentially pathogenic saprophytes while in an ideal environment, acidophilus bacilli are found. In these environments, acidophilus bacilli highly metabolize and produce large amounts of lactic acid by glucose anaerobic fermentation. Preventing the uncontrolled growth of bacteria that are present in the vagina by using the acidic pH of lactic acid that's creating a virtuous circle.

Lactobacillus species is a variety that is dominated the healthy human vagina which plays an essential role in protecting women from genital infection. In the deficiency of lactobacilli, can upset the microbial balance in the vagina which show the syndrome of bacterial vaginosis (BV) that is linked with a quantitative and qualitative shift from normally occurring lactobacilli to a mixed microflora dominated by anaerobic bacteria. It is considered a natural part of vaginal tract and beneficiary to its healthy status. The vagina is protected against pathogens by producing antimicrobials such as bacteriocins, hydrogen peroxide and weak organic acids like acetic acid and lactic acid.

Microbial population is described by the concept of "normal microbiota" as a static that is in need of revision, particularly as better information (including that obtained through developed molecular methodologies that are not dependent on cultural) which changing the present paradigm. With the ability to maintain vaginal health, it is recognized that a spectrum of microbial profiles can produce a stable vaginal ecosystem without submitting to disease. These microbial species inhibit the vaginal tract that plays an important role in the maintenance of health and prevention of infection. In the vagina, the presence of high numbers of lactic acid bacteria (LAB) that is frequently equated with "healthy" and low number or absence, as being "abnormal".

By the administration of antibiotics, urogenital infections can be treated with the undesirable effects of decreasing the number of lactobacilli that cannot restore the urinary tract natural barrier to infections and raise drug resistance. Around 1940, introduce by antibiotics that have many pathogens which developed

antimicrobial drug resistance mechanisms. In clinical isolates, different mechanisms of resistance have been identified including modification of drugs, alteration of drug and reduced access of drug to the intracellular target. Reduced access form of drugs from many micro-organisms that was found to be the result of active drug efflux systems. These so-called multi-drug resistance systems (MDRs) that are mainly responsible for intrinsic or acquired resistance of micro-organisms to anti-microbial drugs. The drug can have side effects including disruption of the protective vaginal microbiota which creates the high risk of urinary tract infections (UTI) and yeast vaginitis.

Antibiotic therapy could have a good alternative source that is vaginal probiotics due to their quality to adhere to uroepithelial cells and produce inhibitors of pathogenic growth and biosurfactant secretion.

## Vaginal Microbiota

In the human body, species occupy sites that can change based on intrinsic host factors such as stage of life cycle, immune response, hormone levels, nutritional status and disease states. The vaginal microbiota can also be altered by external factors such as microbial interspecies completion or commensalism, environmental exposures, and hygiene behaviors. In 1892, the first extensive study of human vaginal microbiota was published by Doderlein. This scientist considered the vaginal microbiota to be homogenous that is consisting only of gram-positive bacilli. These Doderlein's bacilli only known to be the member of genus Lactobacillus species. He described only on single species that is vaginal Lactobacillus acidophilus from a heterogeneous group of diverse bacterial species. More than 20 vaginal Lactobacillus species have been identified, in which 6 really important to the vaginal ecosystem: L. buchneri, L. crispatus, L. iners, L. gasseri, L. jensenii, L. vaginalis. In vaginal microbiota, Bacteroides, Staphylococcus epidermidis, Corynebacterium, Peptostreptococcus, Eubacterium, Atopobium vaginae, Megasphera, Leptotrichia and Mycoplasma can be found.

Lactobacilli bacteria produce lactic acid that may be more abundant in healthy women and especially in colored and Hispanic women. For maintaining a healthy vagina by using the lactic acid and acidic pH. This type of bacteria was found in the vagina that has shown their capacity to inhibit the in vitro growth of various pathogenic micro-organisms.

Within 24h, vaginal vault is colonized by female child's birth and remains colonized until death. At the time of puberty, lactobacilli become predominant inhabitants of the vagina, presumably because of the effect of estrogens on the glycogen content of vaginal epithelial cells. Estrogen production level was reduced that is marked by menopause and give the result in drying and atrophy of the vaginal epithelium. In case of estrogen levels drop, then glycogen content was a drop in vaginal epithelium as well, leading to depletion of lactobacilli. When decreasing the numbers of lactobacilli, resulting in a subsequent rise in vaginal pH, since glucose is not converted to lactic acid. Increasing the values of pH promote the growth of pathogenic bacteria, particularly colonization by entire bacteria.

**Defense Mechanisms of Vagina**

Vaginal Acid pH

In the vagina, coexisting the previous section tackled the large number and variety of germs. In this content, explain the key for maintenance of vaginal health in presence of lactic acid that creates an acidic pH as well as Lactobacillus acidophilus that produce such pH. Through a mechanism, vagina inhibits the growth of pathogens that a striking because of its simplicity and effectiveness.

Lactic acid allows the maintenance of an acidic pH around 3.5-4.5 and this lactic acid is not favorable for the growth of fungi, protozoa, Haemophilus and other unwanted bacteria, which generally need a pH greater than 6.0. Lactobacilli feel comfortable in an acidic environment because it is acidophilic, which enables their maximal proliferation. Lactic acid is produced and physiological state of acidity has following landmarks:

- Estradiol is produced by ovaries.
- The multilayered epithelium of vaginal mucosa proliferates thanks to estradiol which also induces the glycogen loading of these cells.
- In the vaginal lumen, vaginal epithelial cells gradually flake out.
- Desquamated cells release of glycogen that are allowed by a lytic process which is contained in them.
- Acidophilus bacilli via anaerobic fermentation metabolized the glycogen without oxygen. Glucose anaerobic fermentation produces the waste product that is lactic acid, which is the cornerstone to acidify the vaginal environment.

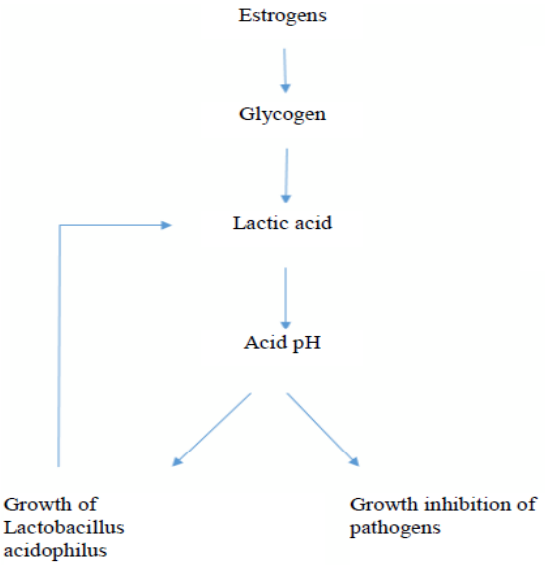


**Figure: Virtuous circle produced in the vagina in the physiological condition**

Antimicrobial activity

In a functional equilibrium, the role that vaginal ecosystem plays in the maintenance of vaginal health that is important. By pathogenic organisms and overgrowth of the organism, healthy equilibrium acts to supply a barrier to new colonization that is otherwise commensal. The mechanisms by which lactobacilli stabilize the vaginal microbiota are the production of antimicrobial compounds (lactic acid, hydrogen peroxide, bacteriocin-like substances) and the capability to compete and adhere for adhesion sites in the vagina.

Hydrogen Peroxide ($H_2O_2$)

Hydrogen peroxide is an oxidizing agent that is toxic to catalase-negative bacteria such as most anaerobic micro-organisms. $H_2O_2$ may also help to prevent the invasions since some vaginal species of Lactobacillus produce $H_2O_2$. By doing some research, suggest that women with $H_2O_2$ producing lactobacilli are less likely to be infected with HIV-1, herpes simplex virus type 2 and pathogens linked with bacterial viruses (BV). By $H_2O_2$, producing some strains that are critical for vaginal defense and activate HIV-1 and increase production of intact virions.

In vagina of healthy women, $H_2O_2$ producing micro-organisms that have been suggested as the bacterial group which is responsible for the maintenance of ecologic balance, mostly in pregnant women. In some studies, shown is not in case of vivo, since dissolved oxygen levels in the vagina are exceptionally low and may limit the amount of hydrogen peroxide produced by lactobacilli to sub-inhibitory levels. This product

most widely used in medical filed as an effective disinfectant that has a negative impact on microbial species with no catalase enzyme which destroys this molecule. The structure of germs is deeply harmed and they end up dying without this enzyme.

Bacteriocins

All genera of Lactic Acid Bacteria (LAB) are produced the bacteriocins that can be divided into different classes based on their biochemical properties. This type of bacteria has a variety of killing mechanisms including cytoplasmic membrane pore formation, interference with cellular enzymatic reactions (such as cell wall synthesis) and nuclease activity. Nisin (a lantibiotic produced by certain strains of Lactococcus lactis) is only one bacteriocin that has been approved by world health organization (WHO) for use as a food preservative. Nisin is not a good choice for vaginal application as it is strongly bactericidal for healthy vaginal Lactobacillus species. For bacteriocins production, LAB strains have also been screened to develop the vaginal probiotics.

**Adherence:** In the vaginal epithelium, the capacity that lactobacilli have to adhere and compete for adhesion sites that can also be involved in inhibition of colonization by a pathogen. Equilibrium of vaginal microbiota can be affected by renewal of superficial epithelium of vagina. The ability of lactobacilli is affected by the factors such as hormonal changes (particularly estrogen), vaginal pH, and glycogen content that to adhere to epithelial cells and colonize the vagina. In vaginal microbiota, menstrual cycle can also cause changes with high concentrations of estrogen increasing adherence of lactobacilli to vaginal epithelial cells.

**Potential of the LAB for use as vaginal probiotics**

The term probiotic is derived from the Greek/Latin word “pro” and the Greek word “bios” that has the meaning for life. The probiotic concept was first introduced by Russian Nobel laureate Elie Metchnikoff in 1907, where he proposed the idea that for human beings, ingesting microbes could have beneficial effects especially to treat digestive diseases. The probiotics were first used by Lilly and Stillwell in 1965 which describes substances secreted by one organism which motivates the growth of another. According to World Health Organization and Food and Agriculture Organization of United Nations, define probiotics as “live microorganisms, which, when administered in adequate amounts, confer a health benefit on the host’’. The probiotic may act indirectly through treating and preventing recurrent bacterial viruses or directly by secreting substances such as hydrogen peroxide, lactic acid, bacteriocins which block sexually transmitted infection.

Urogenital infections contain antimicrobial treatment that is not always effective in which problems remain due to bacterial and yeast resistance, recurrent infections as well as side effects, alternative drugs are of interest to patients and their care givers. It is assumed that recurrences are due to antimicrobials failing to eliminate the pathogens, may be because of biofilm resistance, or that the virulent organisms come back from their source (the person’s gut or a sex partner) and attack a host whose defenses are suboptimal.

Several clinical trials have to be performed to investigate the specific strains of lactobacilli, administered either orally or intra-vaginally that are able to colonize the vaginas of women with asymptomatic or symptomatic BV, to reduce the colonization of pathogens and to improve symptoms and signs of BV when they are present. Probiotics can be administered vaginally or orally because lactobacilli can rise passively from the rectum to the vagina, which can be a significant advance in being able to deliver probiotics in foods and dietary supplements.

**Negative effects of the Probiotic use**

Around the world, approximately one billion doses of probiotics are administrated and those administrated have been tolerating for urogenital. Lactobacillus inhibits the mouth, gastrointestinal tract and female genitourinary tract. Lactobacilli caused the endocarditis and bacteremia that are extremely rare. In most cases, shown with the chronic diseases or debilitating conditions that provide with direct access to the bloodstream from a leaky gut. According to Cribby, 1.7% of 241 cases of bacteremia, endocarditis and localized infection linked with lactobacillus in which considered to have a possible link with heavy consumption of dairy products.

**Review of Literature**

**Dover et.al 2008,** stated that against the bacterial vaginal infection, optimal treatment and prophylaxis should preferably be natural, non-toxic for human or healthy vaginal microflora, biodegradable and cost-effective. From antimicrobials, formulation could be made that produced by Lactobacillus species in combination with other safe and effective substances.

**Gil1 et.al 2009,** dictated that every year worldwide, urogenital infections affect millions of people. By using the antimicrobial agents, treatment of these diseases usually, the use of probiotic lactic acid bacteria (LAB) cultures for the management of vaginal

infections. According to this paper, 11 vaginal lactobacilli separates that are previously obtained from healthy patients and studied about to screen micro-organisms with probiotic properties against Candida species. For their ability of auto-aggregation, co-aggregation tested the LAB with C. albicans, C. glabrata, C. krusei, and C. tropicalis, production of lactic acid and hydrogen peroxide and adhesion to coca-2 epithelial cells. All lactobacilli segregate tested were able to auto-aggregate and to co-aggregate with four candida species into different degrees.

**O'Hanlon, Moench and Cone 2013,** dictated that lactic acid is a potent microbicide that at sufficiently acidic pH and it is produced by vaginal lactobacilli that may help protect against reproductive tract infections. According to this paper, showing 56 women with low Nugent scores (indicating a Lactobacillus-dominated vaginal microbiota) and no symptoms of reproductive tract disease or infection which provided the 64 cervicovaginal fluid samples using a collection method that avoided to need the sample dilution and rigorously minimized aerobic exposure. By using microelectrode, pH of samples was measured immediately after collection and under a physiological vaginal concentration of CO2. For use in CVF, enzymatic assays of total lactate and total acetate concentrations were validated and compared to more usual HPLC method.

**Petricevic et.al 2014,** in early pregnancy, the presence of an abnormal vaginal microflora is a risk factor for preterm delivery. By lactic acid bacteria, there is no investigation on vaginal flora and possible association with preterm delivery. In healthy pregnant women, vaginal Lactobacillus species in early pregnancy in relation to pregnancy outcome. According to this paper, observed 111 low-risk pregnant women with normal vaginal microflora 11+0 and 14+0 weeks of pregnancy without subjective complaints. By using denaturing gradient gel electrophoresis (DGGE), vaginal smears were taken for identification of lactobacilli.

**Wedajo 2015,** in last two decades, tremendous increasing the uses of probiotics LAB and their applications which contain many challenges when claiming the health benefits. Probiotics can help to increase the benefits to the human, animals, and plants. The strain selection, processing, and inoculation of starter cultures must be considered in addition to the viability and sensory acceptance. It cannot be assumed that number of probiotics bacteria are added to the food product that will result in the transferring the health to the subject. In addition to recovery levels, shown that the viability of probiotics throughout the storage period in the gastrointestinal tract are important factors.

**Ghazzewi and Tester 2016,** for preventing/treating vaginal health, have a limited knowledge regarding the use of bio-therapeutic agents (pre and probiotics). Most vaginal infection is treated with drugs but regular reappearances and chronic infections are common due to the adverse effects on the indigenous lactobacilli. Bio-therapeutic agents have the potential to optimize, maintain and restore the microflora of vaginal ecosystem. In reducing vaginal infection, bio-therapeutic agents provide an alternative approach and promoting consumer health.

**Tachedjian et.al 2017,** lactic acid is produced by probiotic lactobacilli with desire D-to-L lactic acid ratios that may be considered "lactic acid" factories and it deliver sustained amounts of this metabolite to the cervicovaginal mucosa. Through regulatory pathways, challenges remain with regard to the advancement of probiotics as "bio-therapeutics" that are adopted in mainstream clinical practice. A positive signal was shown through the several clinical trials for the capability of lactic acid to re-establish vaginal eubiosis and release symptoms in women with BV.

**Valenti et.al 2018,** stated that in the female mucosal genital tract, Lactobacillus species and Lf are pivotal components of a first-line defense that involved in protection against a multitude of microbial infections and a most effective natural mechanism to dampen inflammatory processes. To inhibit the cervicovaginal infections, an ideal drug should inhibit such as microbial adhesion and entry into host cells, microbial growth, microbial intracellular replication and by microbes extracellularly released, infection of new host cells from infected cells. Inhibitions of bacterial multiplication through the synthesis of antibacterial substances by competition or by lactobacilli between Lf and microbes for iron acquisition that represents an effective natural defense mechanism in a vaginal environment of women of childbearing age.

## Conclusion

The important role of lactic acid to control the vaginal infected disease in vaginal healthy women. In the vagina, a large number of saprophytes can be found that is the most important acidophilic bacteria which produce lactic acid. In this paper, concluded that defense mechanism affects and control the vaginal microbiota are still incomplete but analyze the vaginal tract as a microbial ecosystem to understand the full range of mechanism that affects the risk of disease. By using the probiotics, which treat and prevent the infection that has been considered for some time and use for safety record. It is also recognized that LAB has the ability to maintain the vaginal health of women.

## References:

Al-Ghazzewi, F.h., and R.f. Tester. "Biotherapeutic Agents and Vaginal Health." *Journal of Applied Microbiology*, vol. 121, no. 1, 2016, pp. 18–27.

Borges, Sandra, et al. "The Role of Lactobacilli and Probiotics in Maintaining Vaginal Health." *Archives of Gynecology and Obstetrics*, vol. 289, no. 3, 2013, pp. 479–489.

Cribby, Sarah, et al. "VaginalMicrobiota and the Use of Probiotics." *Interdisciplinary Perspectives on Infectious Diseases*, 2008, pp. 1–9.

Dover, S. E., et al. "Natural Antimicrobials and Their Role in Vaginal Health: A Short Review." *Int J Probiotics Prebiotics*, vol. 3, no. 4, 2008, pp. 219–230.

Gil, Natalia F., et al. "Vaginal Lactobacilli as Potential Probiotics against Candida Spp." *Brazilian Journal of Microbiology*, vol. 41, no. 1, 2010, pp. 6–14.

Haya, Javier, et al. "Importance of Lactic Acid in Maintaining Vaginal Health: A Review of Vaginitis and Vaginosis Etiopathogenic Bases and a Proposal for a New Treatment." *Open Journal of Obstetrics and Gynecology*, vol. 04, no. 13, 2014, pp. 787–799.

O'Hanlon, Deirdre E., et al. "Vaginal PH and Microbicidal Lactic Acid When Lactobacilli Dominate the Microbiota." *PLOS ONE*, vol. 8, no. 11, 6 Nov. 2013, pp. 1–8.

Petricevic, Ljubomir, et al. "Characterisation of the Vaginal Lactobacillus Microbiota Associated with Preterm Delivery." *Scientific Reports*, vol. 4, no. 1, 2014.

Tachedjian, Gilda, et al. "The Role of Lactic Acid Production by Probiotic Lactobacillus Species in Vaginal Health." *Research in Microbiology*, vol. 168, no. 9-10, 2017, pp. 782–792.

Valenti, Piera, et al. "Role of Lactobacilli and Lactoferrin in the Mucosal Cervicovaginal Defense." *Frontiers in Immunology*, vol. 9, Jan. 2018, doi:10.3389/fimmu.2018.00376.

Wedajo, Bikila. "Lactic Acid Bacteria: Benefits, Selection Criteria and Probiotic Potential in Fermented Food." *Journal of Probiotics & Health*, vol. 03, no. 02, 2015.