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Short Communication

The Role of the Vaginal Microbiome in Women's Health

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DESCRIPTION

The human body hosts diverse microbial communities, with each anatomical region possessing a unique microbiome that plays an important role in maintaining health. Among these, the vaginal microbiome is particularly significant for women's health, influencing susceptibility to infections, reproductive outcomes and overall well-being. The balance of microbial species in the vagina is necessary for preventing diseases and ensuring proper immune function. Disruptions to this delicate ecosystem can lead to conditions such as bacterial vaginosis, yeast infections and increased risk of Sexually Transmitted Infections (STIs). This article explores the composition, functions and impact of the vaginal microbiome on women's health, as well as strategies for maintaining a balanced microbial environment.

Composition of the vaginal microbiome

The vaginal microbiome consists predominantly of bacteria, with lactobacilli being the most abundant and functionally important microorganisms. Unlike the gut microbiome, which hosts a highly diverse microbial population, a healthy vaginal microbiome is generally characterized by low diversity, dominated by beneficial Lactobacillus species. These bacteria play a critical role in maintaining vaginal health by producing lactic acid, hydrogen peroxide and antimicrobial peptides that protect against infections [1,2].

The most common lactobacillus species found in a healthy vagina include:

Lactobacillus crispatus: Known for its strong ability to produce lactic acid and hydrogen peroxide, offering strong protection against infections.

Lactobacillus iners: Frequently present but less protective than other species, as it can be associated with Bacterial Vaginosis (BV).

Lactobacillus jensenii: Contributes to vaginal health by producing bacteriocins and maintaining a stable microbial environment.

In addition to lactobacilli, the vaginal microbiome may contain a variety of other bacteria, including Gardnerella vaginalis, Atopobium vaginae, Prevotella species and Mobiluncus species. When these bacteria become dominant, they can disrupt the normal microbial balance and lead to conditions such as BV.

Functions of the vaginal microbiome

Maintaining vaginal pH and preventing infections: One of the primary functions of the vaginal microbiome is maintaining an acidic environment, with a pH range of approximately 3.8 to 4.5. This acidity is important for preventing the growth of harmful pathogens. Lactobacillus species contribute to this by fermenting glycogen (supplied by vaginal epithelial cells) into lactic acid. The acidic pH inhibits the colonization of opportunistic and pathogenic microorganisms, reducing the risk of infections such as BV, yeast infections and sexually transmitted diseases.

Protection against Sexually Transmitted Infections (STIs): A well-balanced vaginal microbiome can provide defense against sexually transmitted infections. Studies have shown that women with a Lactobacillus-dominated microbiome have a lower risk of acquiring infections such as chlamydia, gonorrhea and Human Papillomavirus (HPV). Additionally, lactic acid produced by lactobacilli has been found to inactivate HIV and herpes simplex virus, highlighting the microbiome's role in reducing STI susceptibility.

Supporting reproductive and pregnancy outcomes: The vaginal microbiome also plays an important role in reproductive health. A balanced microbiome is associated with improved fertility, successful implantation of the embryo and reduced pregnancy complications.

Women undergoing *In Vitro* Fertilization (IVF) treatments tend to have better success rates when their vaginal microbiome is dominated by Lactobacillus crispatus [3,4].

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Vaginal microbiome dysbiosis and associated health conditions

Disruptions to the vaginal microbiome, often caused by factors such as antibiotic use, hormonal changes, douching, or unprotected sex, can lead to an imbalance known as dysbiosis. This can result in several health issues:

Bacterial Vaginosis (BV): BV is one of the most common vaginal infections and occurs when Lactobacillus levels decline, allowing anaerobic bacteria such as Gardnerella vaginalis and Atopobium vaginae to proliferate. Symptoms include vaginal discharge, odor, itching and discomfort. BV increases the risk of STIs, Pelvic Inflammatory Disease (PID) and adverse pregnancy outcomes [5].

Candidiasis (Yeast Infections): An overgrowth of Candida species, particularly Candida albicans, can result in yeast infections. These infections are characterized by itching, thick white discharge and irritation. While Lactobacillus species generally help prevent yeast overgrowth, antibiotic use, hormonal imbalances and weakened immunity can disrupt microbial balance and lead to recurrent infections.

Increased risk of STIs and HPV persistence: Dysbiosis in the vaginal microbiome is associated with a higher susceptibility to sexually transmitted infections. In particular, BV-related bacteria have been linked to persistent HPV infections, which can increase the risk of cervical cancer. Maintaining a healthy vaginal microbiome may enhance the clearance of HPV and reduce the likelihood of progression to cervical cancer [6,7].

Maintaining a healthy vaginal microbiome

Given the importance of the vaginal microbiome in women's health, several strategies can help maintain microbial balance:

Avoiding douching: Douching disrupts the natural balance of vaginal bacteria, increasing the risk of infections. The vagina is self-cleaning and external washing with mild soap and water is sufficient [8].

Probiotics and prebiotics: Consuming probiotics containing Lactobacillus strains or applying them directly to the vaginal area may help restore balance. Prebiotic-rich foods, such as fiber-rich vegetables, can support beneficial bacterial growth.

Balanced diet: A diet rich in fruits, vegetables and fermented foods supports gut and vaginal microbiota health. A well-functioning gut microbiome indirectly benefits the vaginal microbiome.

Hormonal balance: Estrogen influences the vaginal microbiome by promoting glycogen production, which nourishes Lactobacillus bacteria. Hormonal fluctuations, particularly during menopause, can alter microbial composition, making estrogen therapy a consideration for postmenopausal women experiencing vaginal health issues [9,10].

CONCLUSION

The vaginal microbiome is a key determinant of women's health, influencing infection resistance, reproductive health, immune function and disease susceptibility. A stable Lactobacillus-dominated microbiome provides necessary protective functions, while dysbiosis can contribute to various health issues, including bacterial vaginosis, yeast infections and increased STI risk. Further research into microbiome-targeted therapies holds potential for advancing women's healthcare and improving treatment outcomes for vaginal and reproductive health conditions.

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