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NUTRITION + WELLNESS

The Connection Between UTIs and the Gut Microbiome

Research is beginning to suggest that treating urinary tract infections with antibiotics (the current standard of care) may actually contribute to recurrent infections and exacerbate the cycle of recurrence. Further, given the rise of antibiotic resistance, examination of other methods to prevent urinary tract infections is necessary. There are a significant number of nutritional and supplemental interventions that have proven beneficial in both treating and managing recurrent urinary tract infections. However, an increasing body of research exploring the connection between the gut microbiome and urinary tract infections suggests that supporting gut health may also play a significant role in preventing recurrent urinary tract infections.

Background

Urinary Tract Infections (UTIs) are one of the most common bacterial infections worldwide, with *Escherichia coli* (*E. coli*) being the most common urinary pathogen, responsible for approximately 75-90% of UTI episodes (Kaußner et al., 2022) (Gaby, 2017). *E. coli* promotes infection through adhesion to urothelial cells and contributes to inflammation in the urinary tract (Lenger et al., 2020).

Antibacterial therapy is the current strategy for treatment; however, given the rising levels of antibiotic resistance and the likelihood of reinfection, implementing other means of preventing and managing infections should be prioritized (Kaußner et al., 2022) (Koradia et al., 2019)**.** Studies show that although antibiotic use is effective, it fosters the development of antibiotic resistance of the microorganisms that caused the infection and creates dysbiosis, making reinfection common and thus, triggering a vicious cycle (Ots et al., 2024) (Brigada et al., 2024)**.**

Nearly half of all women experience a UTI in their lifetime, with recurrences affecting approximately 20-30% of women. Recurrences are defined as two UTIs within 6 months or three UTIs within 12 months (Ots et al., 2024). Risks for UTIs other than female sex include age, history of recurrence, sexual activity, diabetes mellitus and a vaginal microbiome comparatively depleted of *Lactobacilli* (Fernández et al., 2024) (Koradia et al., 2019). UTIs are common in postmenopausal women, with more than half of women around age 55 experiencing a UTI. This is largely due to hormonal changes in the vaginal microbiome (Fernández et al., 2024).

Common Nutritional or Supplemental Interventions

A plethora of studies have been conducted on the benefits of various nutritional and supplemental interventions for reduction in the frequency and severity of UTIs. Some of the most common accepted and effective interventions are as follows:

Cranberry. Cranberry based products have been found to significantly reduce the incidence of UTIs in susceptible populations (Xia et al., 2021). Cranberry extracts work by preventing uropathogenic strains of *E. coli* from adhering to human uroepithelial cells and by producing a slight acidification of the urine, which may inhibit the growth of pathogenic bacteria (Gaby, 2017).

Vitamin C. Vitamin C, either intravenously or orally, may have an antibacterial effect on *E. coli* and help to acidify urine (Gaby, 2017).

D-mannose. D-mannose, a simple sugar naturally found in some fruits and vegetables, has been shown to prevent *E. coli* from adhering to the urothelium and is also believed to initiate a signalling cascade that prevents E. coli from invading (Lenger et al., 2020).

Hydration. Increasing daily water intake may help reduce the frequency and duration of UTIs. Increased fluid flushes the bacteria and makes it more difficult for it to attach to uroepithelial cells (Hooten et al., 2018).

Probiotics. Probiotics, both taken orally and administered intravaginally, have reduced the duration and frequency of UTIs. There are several *Lactobacillus* strains that have proven to be preferable to other strains. They work by competitively excluding pathogenic organisms and by producing compounds that inhibit the growth of pathogens (Abdellah et al., 2024) (Gaby, 2017).

Estrogen Replacement Therapy. Both oral estrogen and intravaginal estriol therapy have been shown to reduce the incidence of UTIs in postmenopausal women by lowering vaginal pH and increasing the number of lactobacilli in vaginal flora (Fernández et al., 2024) (Gaby, 2017).

More recently, and in light of the growing impact of antibiotic resistance, researchers have been studying why some individuals appear to be more susceptible to UTIs than others. While some of the focus has been on genes and antibiotic resistant strains of infection, the most promising focus is shifting toward the gut microbiome.

Maintaining the Health of the Gut Microbiome

Beyond direct treatment, a new frontier is emerging: targeting the gut itself. A growing number of studies suggest that managing the variety and health of the gut barrier and intestinal flora may help to prevent and/or reduce the frequency of UTIs. While there is a great deal more information to be studied here, the question posed was "whether interventions targeting the gut microbiome might reduce the frequency or severity of *E. coli* related UTIs" The PICO used for this research was:

- **Population**: Adults with recurrent UTIs caused by *E. coli*
- **Intervention**: therapies targeting the gut microbiome
- **Control**: no intervention
- **Outcome**: result in reduced UTIs compared to no intervention

Leaky Gut and UTIs

The gut plays a critical role in both preventing the translocation of bacteria from the digestive tract to other parts of the body and maintaining the body's immune function. Intestinal permeability, or "leaky gut," refers to the condition when the gut's intestinal barrier has been compromised. Leaky gut has been associated with both systemic inflammation as well as the translocation of bacteria to the bladder, both of which are associated with UTIs (Brigada et al., 2024).

There is growing evidence that, in cases of leaky gut, the bacteria most commonly found in UTIs, *E. coli*, may originate from the gut, through direct migration of the bacteria through the bloodstream. While *E. coli* may commonly inhibit the digestive tract, it becomes an opportunistic pathogen in the urinary tract. Once it enters the bloodstream, *E. coli* makes its way to the bladder, where it colonizes. At the same time, their presence in the blood stream triggers an immune response, but the immune response is impaired by systemic inflammation as a result of the leaky gut, further increasing the risk of UTIs. Thus, restoring gut barrier function and managing dysbiosis may help reduce the risk of UTIs (Brigada et al., 2024) (Young et al., 2024).

Variations in Commensal Bacteria and UTIs

Several studies have demonstrated that the gut microbiota of patients with recurrent UTIs is different from those of healthy individuals. Specifically, women suffering from recurrent UTIs exhibit gut dysbiosis characterized by low levels of butyrate producers and reduced microbial diversity (Worby et al, 2022) (Young et al., 2024). In one study, it was observed that *E. coli* was found both in the gut and in the urine of healthy women; however women with recurrent UTIs had low level gut inflammation associated with leaky gut (Worby et al., 2022). It was hypothesized that women in the control group were able to clear the bacteria from their bladders before they caused disease, and women with recurrent UTIs were not, because of a distinct

immune response to bacterial invasion of the bladder potentially mediated by the gut microbiome.

In another study, the gut microbiomes of women with active UTIs caused by antibiotic resistant organisms were compared to the gut microbiomes of healthy women. Those with active UTIs exhibited depleted levels of *Parasutterella*, *Akkermansia* and *Bilophila*, all of which contribute to gut barrier protection or reducing inflammation. Significantly, the women with UTIs exhibited increased *E. coli* levels in the gut 7–14 days after antibiotic treatment, suggesting that antibiotic use may actually promote *E. coli* proliferation in the gut (Choi et al., 2024).

Conclusion

Evidence connecting recurrent UTIs to the condition of the gut microbiome is continuing to mount; yet more research is needed to explain the exact driver of UTI susceptibility. Even without evidence of the precise drivers, it is clear that the microbiome plays a central role in recurrent UTIs and further, that the use of antibiotics may be counterproductive. Although antibiotics may eliminate a current infection, they simultaneously disrupt the microbiome and contribute to dysbiosis, ultimately increasing the risk of further UTIs (Brigada et al., 2024) (Choi et al., 2024).

These studies, and others like them, indicate that interventions targeting the gut microbiome are likely to prevent or reduce the frequency of UTIs. While more research in this arena will certainly be forthcoming, practitioners have an excellent starting point for helping their clients maintain health. Those working with a client with a history of UTI would be well advised to focus on targeted interventions aimed at reducing leaky gut and improving intestinal barrier function as well as reducing systemic inflammation. This may include food sensitivity testing - an often overlooked source of chronic inflammation, immune activation and disruption of the gut barrier. In addition to ensuring a healthy and robust fiber rich diet, this would also include evaluating overall gut health, preferably by conducting a comprehensive stool analysis, and evaluating the efficacy of the client's entire digestive system.

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