 Topic: In what ways does the utilization of cranberry supplements minimize the reoccurrence of urinary tract infections caused by *E.coli*?

**Introduction**

It is estimated that at least 60% of women in the United States have contracted urinary tract infections at some point in their life and because of UTIS  high prevalence, it is a cause for health concern.(Hisano et al., 2012).   The use of cranberries has become the traditional choice of most women to prevent urinary tract infections.As recent studies have proven  cranberries work mainly by hindering the sticking of *Escherichia coli* to urotheliumfound in the lower urinary tract and contains antibacterial as well as anti-inflammatory properties. Anti-adherence activity against gram negative bacteria isolated from urine was observed in volunteers that were given a cranberry juice cocktail which proved its effectiveness in treatments (Das, 2020).  The recurrence of urinary tract infections, following antibiotic treatments suggests *E. coli’s* resistance therefore  alternative medicine is currently being explored. Urinary tract infections are diseases caused by *E.coli* which is a microorganism found in the human gut. The human gut acts as a pool for this bacteria and when it is released through excrement it then attacks the urethra causing an infection; however, cranberries have components that hinders the sticking of this bacteria to cells found in the urethra.. Cranberry supplements can be used to minimize the reoccurrence of urinary tract infections caused by *E.coli* due to their anti-adhesive agents, immunologic response to bacteria and the ability to reduce *E.coli* colonies.

**Anti-adhesive properties of cranberry aids in reducing *E. coli* manifestation**.

Indeed, the anti-adherent properties of cranberry aid in reducing *E. coli* manifestation, by preventing it from sticking to uroepithelial cells in the urinary tract thus reducing the recurrence of UTIs. Consumption of cranberry supplements is a major step in preventing the pathogenesis of *E.coli* because cranberry acts as anti-adhesive agents in inhibiting the adherence of pathogens to the uroepithelial cell receptors in urinary tract (González de Llano et al., 2020). This shows that cranberry compound hinders the development of *E.coli* because it prevents the sticking of bacteria to the cells that line the bladder, ureters and urethra thus preventing infection. Consequently, in order for *E. coli* to manifest in the urinary tract it has to inhibit the uroepithelial cells, however, this action can be prevented by consuming cranberry compounds which exhibit non sticking agents, that aids in reducing the recurrence of UTIs. Research study showed that anti adherence activity was seen in the urine of 15 of 22 subjects 1-3 hours after drinking cranberry juice. This demonstrates how significant cranberry intake is in aiding  the reduction of UTIs recurrence. This information coordinates with that of the initial research topic, where numerous studies show that *E.coli* recurrence is minimized by consuming cranberry compounds which prevents UTI from re-emerging.

In addition, cranberries aid in reducing *E.coli* prevalence by using its anti- adherent properties to prevent the adherence of *E. coli* to the cells that line the urinary bladder in the urinary tract thus reducing UTIs. Cranberry compounds are used to inhibit the bacterial adhesins and mannose-sensitive fimbrial adhesins that are found in uropathogenic *E. coli* (Raz et al., 2004). This indicated that the consumption of cranberry is used to restrain protein found on the surface of bacteria which aids *E. coli* in attaching to the urinary tract, which then leads to UTIs. Granted that the adhesin compounds found on the surface of  *E.coli* is interdicted by consuming cranberries; it then prevents *E.coli* from attaching to the uroepithelial cells hence preventing UTIs. This reinforces the preceding information that cranberry consumption reduces UTIs ingemination because they are used to restrain bacterial growth of *E. coli* in the urinary tract. Research revealed that of the 60 patients infected by E.coli , 53% had a positive result showing that it was unable to attach to uroepithelial cells and 20% showed a more modest result when cranberry juice was consumed thus reducing *E. coli* manifestation. It can be inferred that the iteration of UTIs is prevented by consuming cranberries. This is a proven medical alternative to reduce the recurrence of UTIs.

**Cranberries and their immunological response to bacteria**

In addition to their anti-adhesive properties, frequent consumption of cranberries and their by-products can be extremely helpful in boosting the immunological response to bacterial infections in the urinary tract including that of *E.coli*; due to their antibacterial properties. Consumption of cranberry compounds relieves adverse symptoms of *E. coli* by quelling inflammatory cascade as an immunologic response to bacteria invasion in the urinary tract (González de Llano et al., 2020).This suggests that, ingesting cranberries or their products can assist in enhances the human body’s immune response function by removing the presence of  the *E. coli* bacteria that triggered the inflammatory cascade which reduces inflammation experienced in the urinary tract. By extension, this suppresses the symptoms associated with *E.coli*, for example, urgent and frequent need to urinate and burning sensation followed by pain in the urethra when urinating . Thus, these symptoms are experienced less often while cranberry products are continuously consumed versus if they are not consumed .

Moreover,  antibacterial properties that contribute to the enhancement in the immunological response stems from acids found in cranberries and their by-products . These acids cause chemical reactions which can damage the cells of microorganisms and restrict their functions. Citric and malic acid which are used as food preservatives and are also in cranberry juice, are capable of inhibiting the functions of a wide variety of microorganisms including *E. coli* and other gram-negative bacteria. (Struve et al., 2017).This indicates that the acid mixtures found in cranberries and their products produce an antibacterial effect which is beneficial in boosting the immune response to bacteria. It also suggests that out of all the acids present in cranberries, this antibacterial effect is strongest in the mixtures of citric and malic acid. This makes cranberries extremely useful for reducing the numbers of bacteria in the urinary tract and limits their ability to cause harm thus enhancing the body’s immune response.

**Cranberry supplements result in a decrease in the colonies of *Escherichia Coli***

        Subsequently,  regular consumption of cranberry supplements results in a decrease in the population of *E.coli* present in the human body, which minimizes the recurrence of urinary tract infection. Cranberries are generally used as a natural alternative to antibiotics as they contain chemicals such as polyphenols that have properties that inhibit the growth of harmful bacteria (González de Llano et al., 2019). This means that cranberries contain chemicals that can prevent the reproduction and growth of *E. coli*. Due to an increase in resistance of bacteria to antibiotics , alternative methods such as taking cranberry supplements that actively inhibit the growth of *E.coli* are often used to prevent the recurrence of UTIs. By consuming these supplements consumers are able to decrease their chances of reinfection while using natural alternatives. Research done indicated that the growth of *E. coli* was inhibited by 25% when cranberries were used.  This information provided aligns with the research topic as it shows that cranberries contain chemicals such as polyphenols that actively fight against *E.coli* by inhibiting its growth. This reduces the population of bad bacteria present in the body which lowers the chance of  being reinfected. It also shows that since cranberries contain chemicals that are capable of providing these benefits, the higher the intake of them, the greater the chance of minimizing reinfection.

Likewise, cranberry supplements have the ability to lower the inhabitants of bad bacteria such as *E.coli* and increase the habitants of good bacteria such as *Bacteroidaceae* in the human gut. A decrease in the abundance of bacteria that causes disease and a major increase in the number of bacteria that are important for human health was observed when cranberry extracts were used (O’Connor et al., 2019). This observation shows that cranberry supplements have the potential to minimize the recurrence of UTIs by reducing the population of *E.coli* while increasing the population of important bacteria. By decreasing the population of harmful bacteria, a positive effect in consuming cranberry supplements is obtained. Research conducted showed a 20% reduction in the relative abundance of bad bacteria and a double in good bacteria. This highlights another benefit of consuming these supplements as unlike antibiotics, cranberry supplements increase the number of good bacteria present which promotes a healthy bacterial flora. By promoting an increase in good bacteria in the body, they provide a person with more bacteria that can fight against the harmful ones. This reinforces that cranberry supplements can reduce the population of *E. coli*, promote the growth of good bacteria in the human gut which is necessary for a healthy individual and reduce the recurrence of UTIs as seen in the thesis statement.

**Conclusion**

To summariz**e,** the use of cranberry supplements can be useful in reducing the recurrence of urinary tract infections caused by *E.coli*. Cranberry supplements are said to contain anti-adhesive properties that hinder the sticking of *Escherichia coli* to cells found in the urethra. While it is a good anti-adhesive agent, it also boosts an immunologic response to bacterial infection. It operates by subduing symptoms of urinary tract infections at the same time reducing the colonies of *E.coli* creating in the process an abundance of other bacteria*.* Our team explored this idea because of the frequency of UTIs and the growing resistance of  *E.coli* to antibiotics. We want the audience to know that there are alternative medicines that can be explored. It is recommended that for preventing infections supplements containing 120-800 mg of dried cranberry taken once or twice daily have been used. Drinking cranberry juice 120-300ml 1-3 times daily can also be effective. These measurements were seen in the sources that were evaluated and can be taken into consideration by a person who suffers from this disease.