

# Research Supports D-Mannose for UTIs

## Anti-bacterial defense mechanism of the urinary bladder. Role of d-mannose in urine.

Toyota S, Fukushi Y, Katoh S, Orikasa S, Suzuki Y [Article in Japanese]

Bacterial adherence to mucosa is thought to be an initial and important stage to cause urinary tract infection. Among some mechanisms of bacterial adherence, the role of fimbriae and its receptor is worthy of notice. In particular, type 1 fimbriae, for which mannose is assumed as a receptor, is reported as the most common type and called "common fimbriae". Therefore if a certain amount of mannose is present in urine, it will cover the fimbriae of bacteria and competitively block the bacterial adherence to bladder mucosa. As the first step, we tried to detect mannose in urine by high performance liquid chromatography (HPLC). Sugar can be measured by detecting the fluorescence which is produced by a sugar separated by ion exchange, reacting with arginine at high temperature. The results using standard sugar samples should have highly stable retention time and concentration curve with the minimum detectable mannose concentration of 0.02 microgram. We investigated mannose in urine from 186 cases. Since the mannose peak was often masked by near unidentified peaks, the peak of mannose could be detected only in 80 cases and its concentration could be measured only in 24 cases. Mannose concentration in the urine of the 24 cases was between 2.6 and 108.7 micrograms/ml and in most of cases it was lower than 20 micrograms/ml. Secondary, we examined the possibility of a mannose in urine to prevent bacterial adherence to mucosa by the hemagglutination test using guinea pig erythrocytes and type 1 fimbriated E. coli.(ABSTRACT TRUNCATED AT 250 WORDS)

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## Effect of D-mannose and D-glucose on Escherichia coli bacteriuria in rats.

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Michaels EK, Chmiel JS, Plotkin BJ, Schaeffer AJ.

The effect of D-mannose and D-glucose on bacteriuria due to Escherichia coli with mannose-sensitive adhesins was investigated in adult male Sprague-Dawley rats undergoing diuresis. Inocula of 10(5), 10(7), or 10(8) bacteria in 0.1 ml of normal saline or 2.5% or 10% D-mannose or D-glucose were injected intravesically and urine was cultured 1, 3, 5, 7 and 9 days later. The levels of bacteriuria on days 1 and 5 were significantly lower in rats inoculated with 10(5) E coli and 10% D-mannose than in controls (p less than 0.05 and 0.01 respectively) and the percentages of rats with less than 100 bacteria/ml were higher on days 1 and 3 (p = 0.05 and 0.02 respectively). Bacteriuria was significantly lower in rats inoculated with 10(7) bacteria and 10% D-mannose than in controls on days 5 and 7 (p less than 0.01 for each day) and the percentage of rats with less than 100 bacteria/ml was higher on day 7 (p = 0.01). D-glucose reduced bacteriuria significantly only with a concentration of 10% after instillation of 10(5) E. coli (p less than 0.05, day 1). The results indicate that D-mannose and D-glucose can significantly reduce bacteriuria within 1 day and that their efficacy is dependent upon the concentration of both saccharide and bacteria.

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## **Safe as mother's milk: carbohydrates as future anti-adhesion drugs for bacterial diseases.**

Department of Biological Chemistry, The Weizmann Institute of Science, Rehovot, Israel.  
[bfsharon@weizmann.weizmann.ac.il](mailto:bfsharon@weizmann.weizmann.ac.il) Sharon N, Ofek I.

The majority of infectious diseases are initiated by adhesion of pathogenic organisms to the tissues of the host. In many cases, this adhesion is mediated by lectins present on the surface of the infectious organism that bind to complementary carbohydrates on the surface of the host tissues. Lectin-deficient mutants often lack ability to initiate infection. Soluble carbohydrates recognized by the bacterial lectins block the adhesion of the bacteria to animal cells *in vitro*. Moreover, they have also been shown to protect against experimental infection by lectin-carrying bacteria in different organs of mammals such as mice, rabbits, calves and monkeys

**Zafiri D, Ofek I, Adar R, Pocino M, Sharon N Department of Human Microbiology, Sackler Faculty of Medicine, Tel Aviv University, Israel.**

Inhibition of bacterial adherence to bladder cells has been assumed to account for the beneficial action ascribed to cranberry juice and cranberry juice cocktail in the prevention of urinary tract infections (A. E. Sobota, J. Urol. 131:1013-1016, 1984). We have examined the effect of the cocktail and juice on the adherence of *Escherichia coli* expressing surface lectins of defined sugar specificity to yeasts, tissue culture cells, erythrocytes, and mouse peritoneal macrophages. Cranberry juice cocktail inhibited the adherence of urinary isolates expressing type 1 fimbriae (mannose specific) and P fimbriae [specific for alpha-D-Gal(1 -- -- 4)-beta-D-Gal] but had no effect on a diarrheal isolate expressing a CFA/I adhesin. The cocktail also inhibited yeast agglutination by purified type 1 fimbriae. The inhibitory activity for type 1 fimbriated *E. coli* was dialyzable and could be ascribed to the fructose present in the cocktail; this sugar was about 1/10 as active as methyl alpha-D-mannoside in inhibiting the adherence of type 1 fimbriated bacteria. The inhibitory activity for the P fimbriated bacteria was nondialyzable and was detected only after preincubation of the bacteria with the cocktail. Cranberry juice, orange juice, and pineapple juice also inhibited adherence of type 1 fimbriated *E. coli*, most likely because of their fructose content. However, the two latter juices did not inhibit the P fimbriated bacteria. We conclude that cranberry juice contains at least two inhibitors of lectin-mediated adherence of uropathogens to eucaryotic cells. Further studies are required to establish whether these inhibitors play a role *in vivo*.

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[See also Dr. Jonathan Wright's article on mannose and urinary tract infections online <http://www.tahoma-clinic.com/mannose.shtml> ] Am J Vet Res 2000 Apr;61(4):446-9  
Use of specific sugars to inhibit bacterial adherence to equine endometrium *in vitro*.  
King SS, Young DA, Nequin LG, Carnevale EM

Department of Animal Science, Food, and Nutrition, College of Agriculture and Science, Southern Illinois University, Carbondale 62901, USA. OBJECTIVE: To determine whether specific sugars inhibit adhesion of *Streptococcus zooepidemicus*, *Pseudomonas aeruginosa*, and *Escherichia coli* to equine endometrial epithelial cells in vitro. SAMPLE POPULATION: Endometrial biopsy specimens collected during estrus from 7 healthy mares. PROCEDURE: Endometrial specimens on glass slides were incubated for 30 minutes at 4 C with suspensions of *S. zooepidemicus*, *P. aeruginosa*, or *E. coli* in phosphate-buffered saline solution (PBSS) alone or with various concentrations of D-(+)-mannose, N-acetyl-D-glucosamine, N-acetyl-D-galactosamine, D-(+)-glucose, galactose, or N-acetyl-neuraminic acid. Inhibition of bacterial adherence was determined by comparing adhesion of bacteria (i.e., percentage of glandular epithelial cells with adherent bacteria) suspended in each sugar solution with that of bacteria suspended in PBSS. RESULTS: Mannose and N-acetyl-D-galactosamine inhibited adhesion of *E. coli* and *P. aeruginosa* to epithelial cells, whereas only mannose inhibited adhesion of *S. zooepidemicus*. The other sugars did not affect bacterial adherence. CONCLUSIONS AND CLINICAL RELEVANCE: Mannose and N-acetyl-D-galactosamine appear to play a role in adhesion of *S. zooepidemicus*, *P. aeruginosa*, and *E. coli* to equine endometrium. In horses with uterine infections, use of sugars to competitively displace bacteria from attachment sites on cells may provide an adjunct to antibiotic treatment. PMID: 10772112

Effect of D-mannose and D-glucose on *Escherichia coli* bacteriuria in rats, *Urol Res* 11(2):97-102, 1983.

Mannose-sensitive adherence of *Escherichia coli* to epithelial cells from women with recurrent urinary tract infections, *J Urol* 131(5):906-910, May 1984.

Mannose-sensitive hemagglutination in the absence of piliation in *Escherichia coli*, *Mol Microb* 4(8):1311-1318, August 1990.

Mannose Sensitive Adherence of *Escherichia coli* to Epithelial Cells. Eighty-First Annual Meeting of the American Society for Microbiology. Dallas, Texas. March 2-4, 1981.

Effect of D-Mannose on *Escherichia coli* Adherence to Human Vaginal Epithelial Cells and Hemagglutination. American Urological Association. Seventy-Sixth Annual Meeting. Boston, Massachusetts. May 11, 1981

Prevention of *Escherichia coli* Bacteriuria in Rats by D-Mannose. American Urological Association. Boston, Massachusetts. May 11, 1981.

Regulation of Mannose-Sensitive Hemagglutination in Clinical Isolates of *Escherichia coli*. In Kass EH, Svanborg-Eden C, eds:

Host-Parasite Interactions in Urinary Tract Infections 115-121, Chicago, Illinois, 1989. The University of Chicago Press.

Contribution of *Escherichia coli* Type I Pili to Ascending Urinary Tract Colonization in Mice. eds: Host-Parasite Interactions in Urinary Tract Infections 341-347, Chicago, Illinois, 1989. The University of Chicago Press.