Prevention of UTI (urinary tract infections) using yeast betaglucan and various natural substances (mannose, cranberry extract)

Vaclav Vetvicka

University of Louisville School of Medicine, Louisville, KY USA

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Urinary tract infection represents common problem for both general public and for athletes. Repeated infections are, at least partly, caused by depressed immune system, betaglucan is well-established immunomodulator with known helping effects in all types of infections. Therefore, we prepared a project which should be able to experimentaly confirm the hypothesis that betaglucan alone or in combination with some additional natural molecule can have beneficial effects in this type of infection. The aim of this study was to evaluate the effects of some natural molecules as potential food supplement in UTI. For these experiments we used betaglucan, mannose, cranberry extract and their combinations.

We used BALB/c mice, 2 month old, both sexes. UTI was induced via direct inoculation of 10 µl *E. coli* into the bladder using syringe and soft polyethylene tubing (Hopkins et al., 1995, Rosen et al., 2008). Individual samples were used orally in 2 mg/kg or 4 mg/kg doses at different intervals. Mice were sacrificed at various intervals (6, 24, and 72 hrs) and organs (bladder and right kidney) were aseptically collected. After weighting, organs were homogenized in sterile PBS. Obtained material was centrifuged in order to discard the parts of the tissue. Appropriate dilutions were plated on Petri dishes withLevine EMB agar (Difco) and incubated at při 37^{o}C. 24 hrs later, CFU were evaluated.

Results summarized in Figure 1 showed that in case of low dose (2 mg/kg) used for 7 days, the most effective is betaglucan+cranberry combination followed by betaglucan. Mannose showed no effects. Basically same results were found even in case of a double dose (Figure 2). In both cases the bacteria were counted in the bladder. In order to evaluate the optimal dose of supplementation, we used the tested material for a longer period, but the results were similar (Figures 3 and 4).

Second part of the study evaluated the levels of *E.coli* in kidney. We used the same doses as mentioned above, but the intervals were extended to 10 and 21 days. Our results confirmed the previous data – the most effective is the combination of betaglucan and cranberry extract, followed by betaglucan and cranberry extract (Figures 5 to 8).

We can conclude that most of all betaglucan-cranberry combination can be recommended as a great part of food supplementation which can, particularly in case of long term application, significantly improve the urinary tract infection.

Reference

Hopkins WJ, Hall JA, Conwaz BP, Uehling DT.: Induction of urinary tract infection by intraurethral inoculation with *Escherichia coli*: Refining the murine model. J. Inf. Dis., 171:462-465,1995.

Rosen DA, Hung CS, Kline KA, Hultgren SJ.: Streptozocin-induced diabetic mouse model of urinary tract infection. Infect. Immun. 76:4290-4298, 2008.

Figure 1

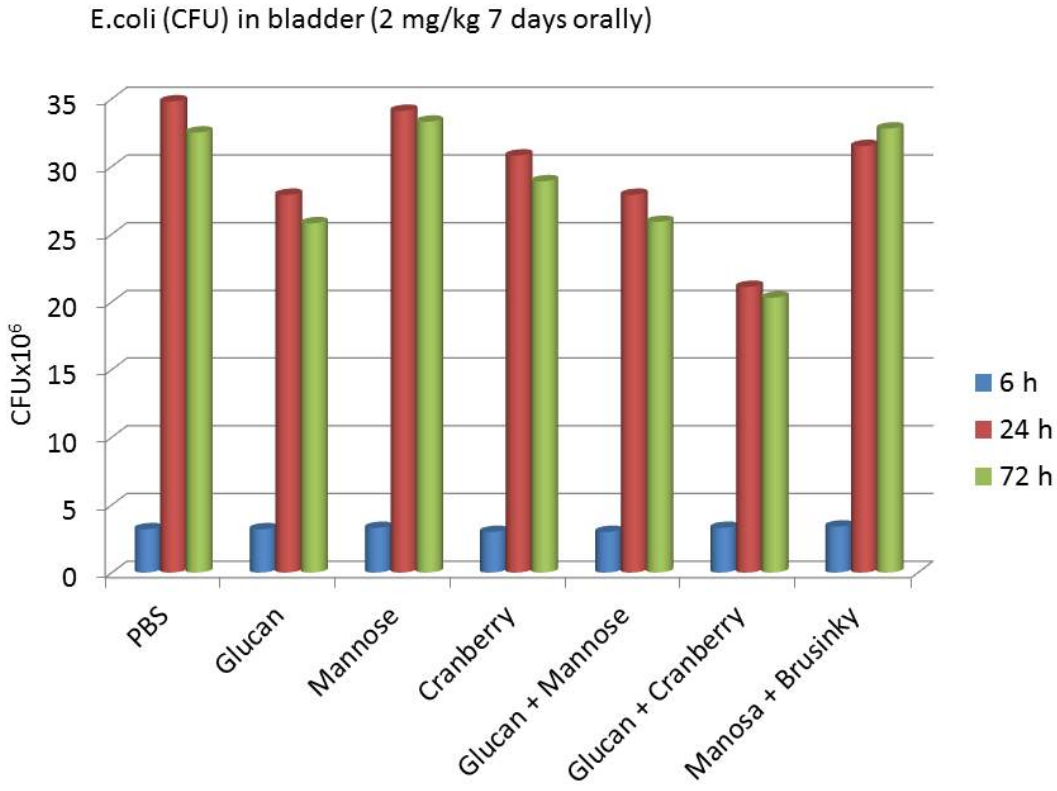


Figure 2

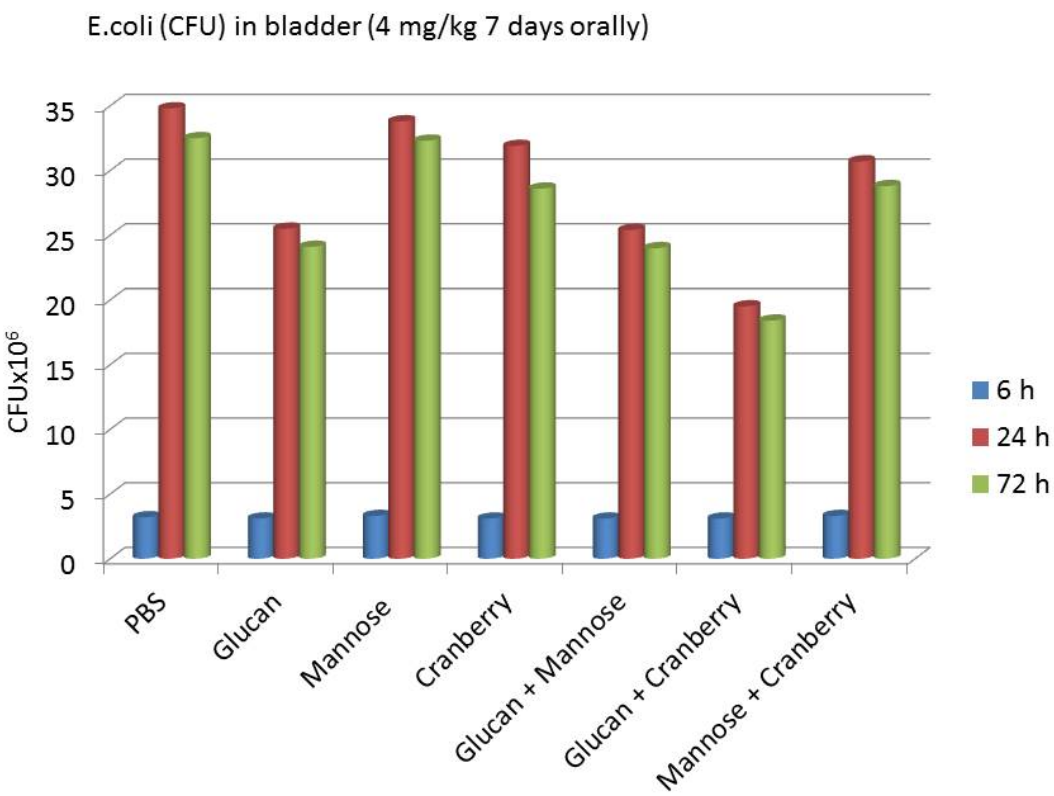

E.coli (CFU) in bladder (4 mg/kg 7 days orally)
CFUx10⁶
35
30
25
20
15
10
5
0
PBS
Glucan
Mannose
Cranberry
Glucan + Mannose
Glucan + Cranberry
Mannose + Cranberry
6 h
24 h
72 h

Figure 3

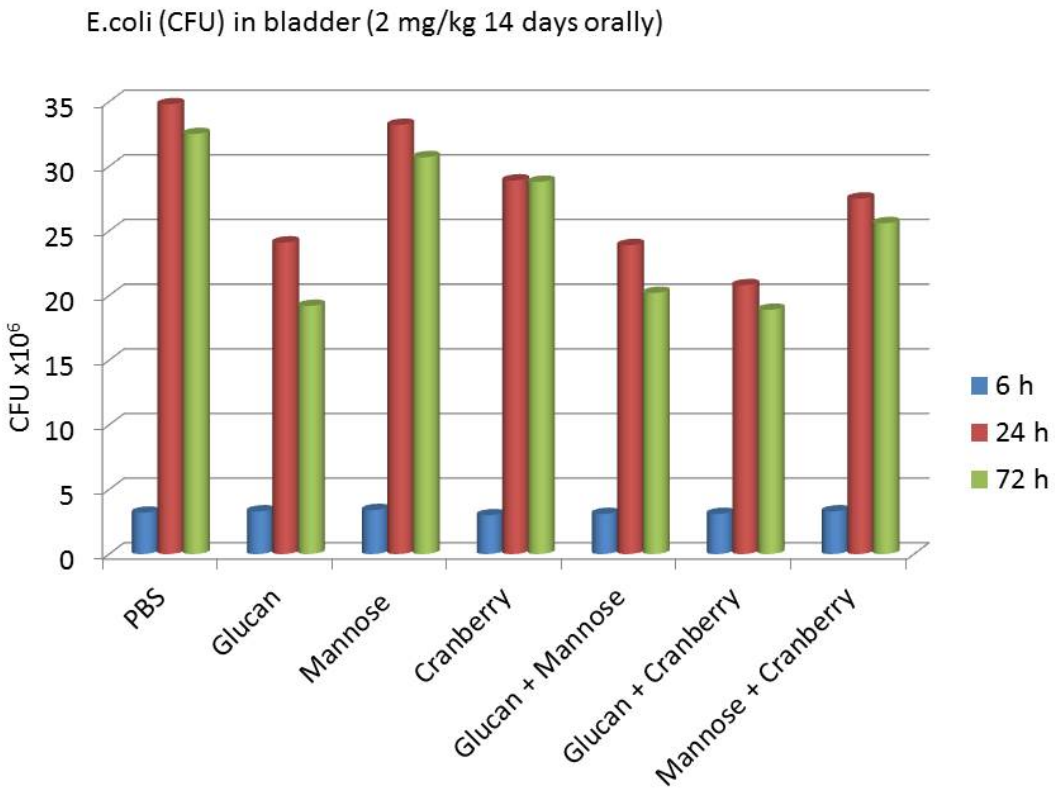

E.coli (CFU) in bladder (2 mg/kg 14 days orally)
CFU x10^6
35
30
25
20
15
10
5
0
PBS
Glucan
Mannose
Cranberry
Glucan + Mannose
Glucan + Cranberry
Mannose + Cranberry
6 h
24 h
72 h

Figure 4

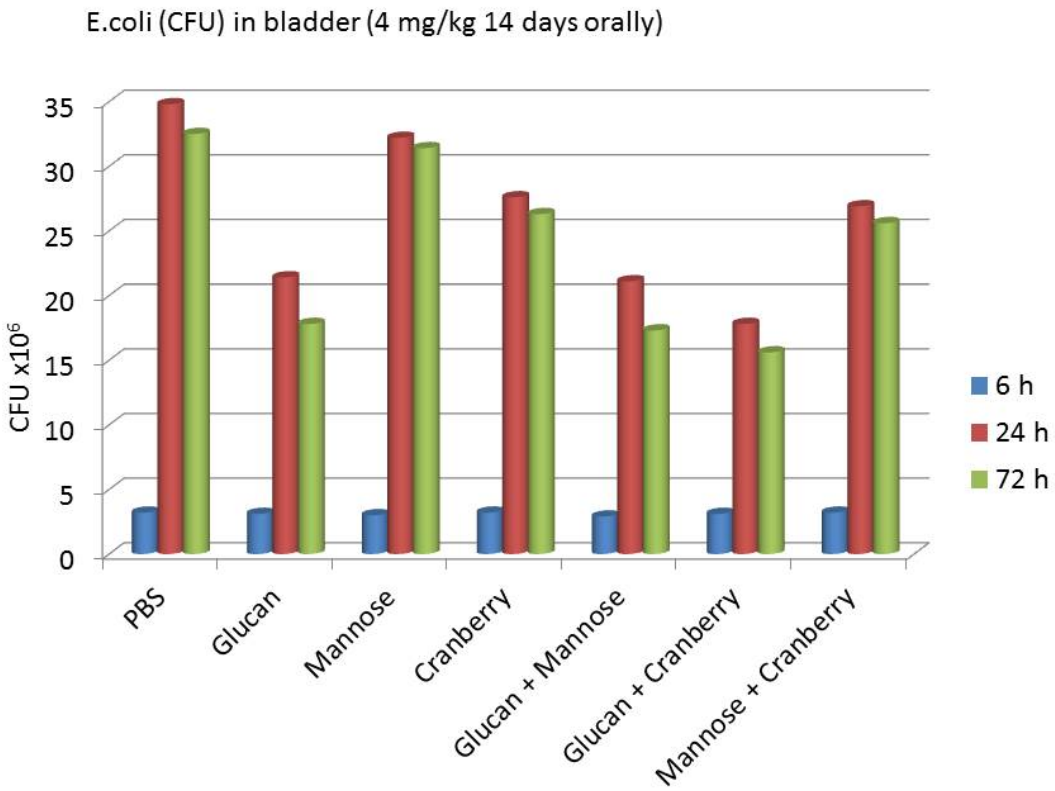

E.coli (CFU) in bladder (4 mg/kg 14 days orally)
CFU x10^6
35
30
25
20
15
10
5
0
PBS
Glucan
Mannose
Cranberry
Glucan + Mannose
Glucan + Cranberry
Mannose + Cranberry
6 h
24 h
72 h

Figure 5

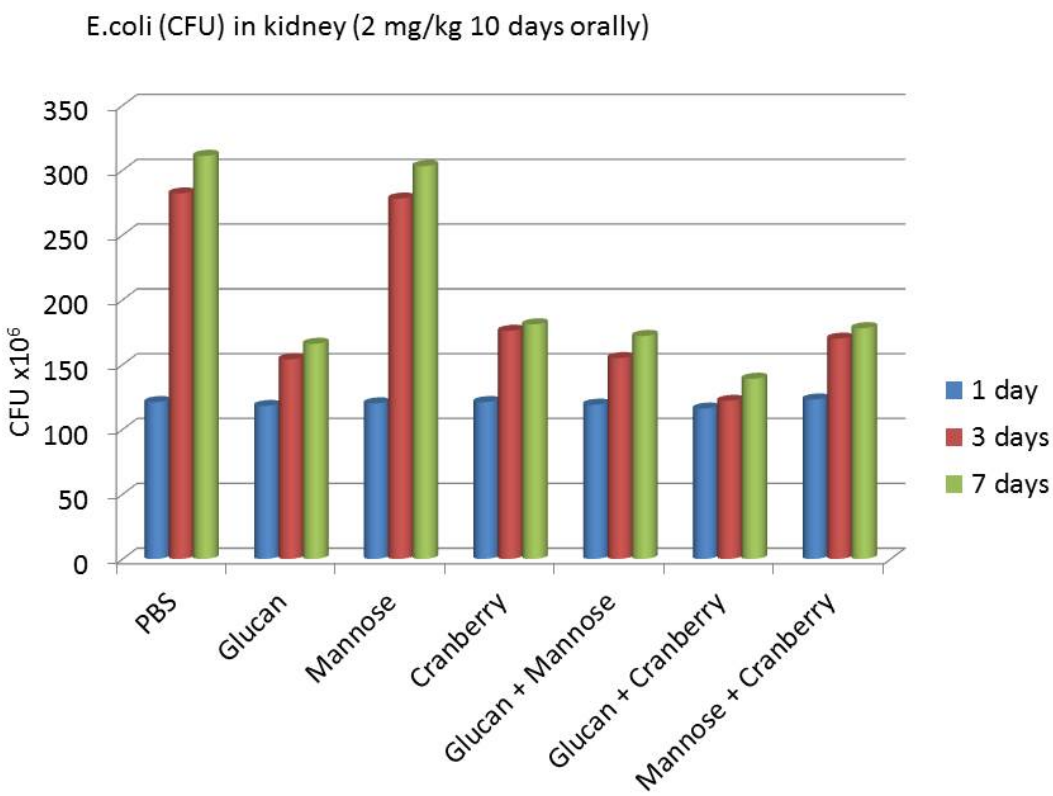

E.coli (CFU) in kidney (2 mg/kg 10 days orally)
CFU x10^6
350
300
250
200
150
100
50
0
PBS
Glucan
Mannose
Cranberry
Glucan + Mannose
Glucan + Cranberry
Mannose + Cranberry
1 day
3 days
7 days

Figure 6

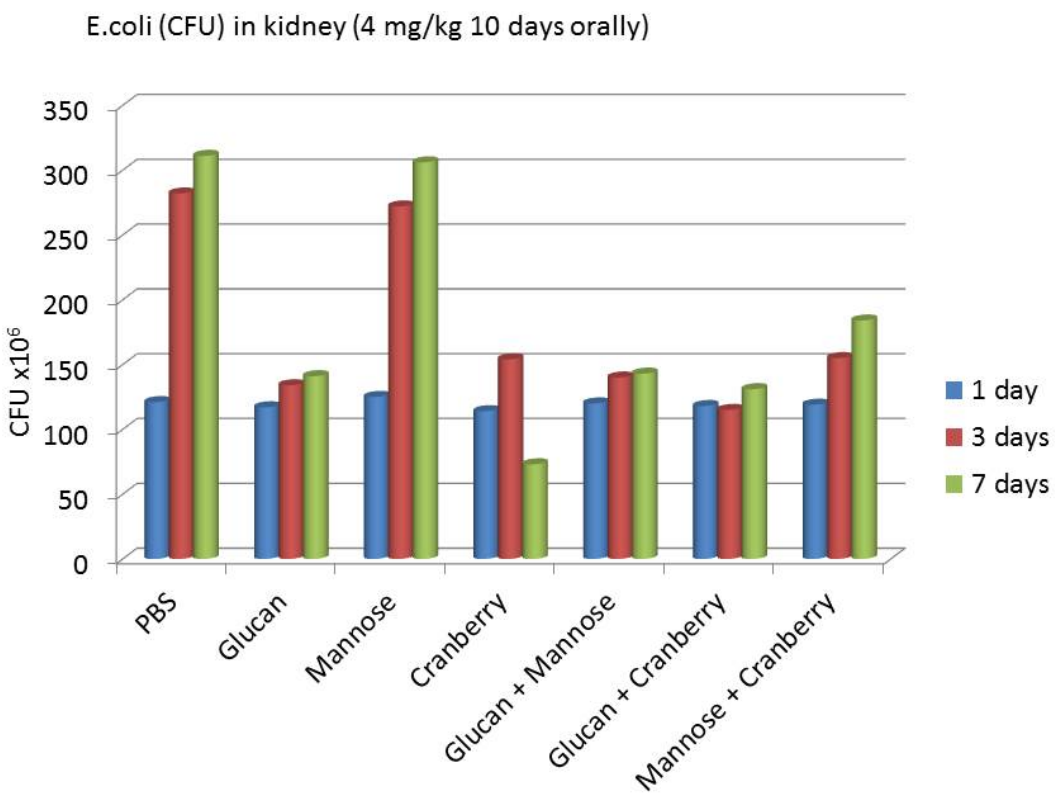

E.coli (CFU) in kidney (4 mg/kg 10 days orally)
CFU x10^6
350
300
250
200
150
100
50
0
PBS
Glucan
Mannose
Cranberry
Glucan + Mannose
Glucan + Cranberry
Mannose + Cranberry
1 day
3 days
7 days

Figure 7

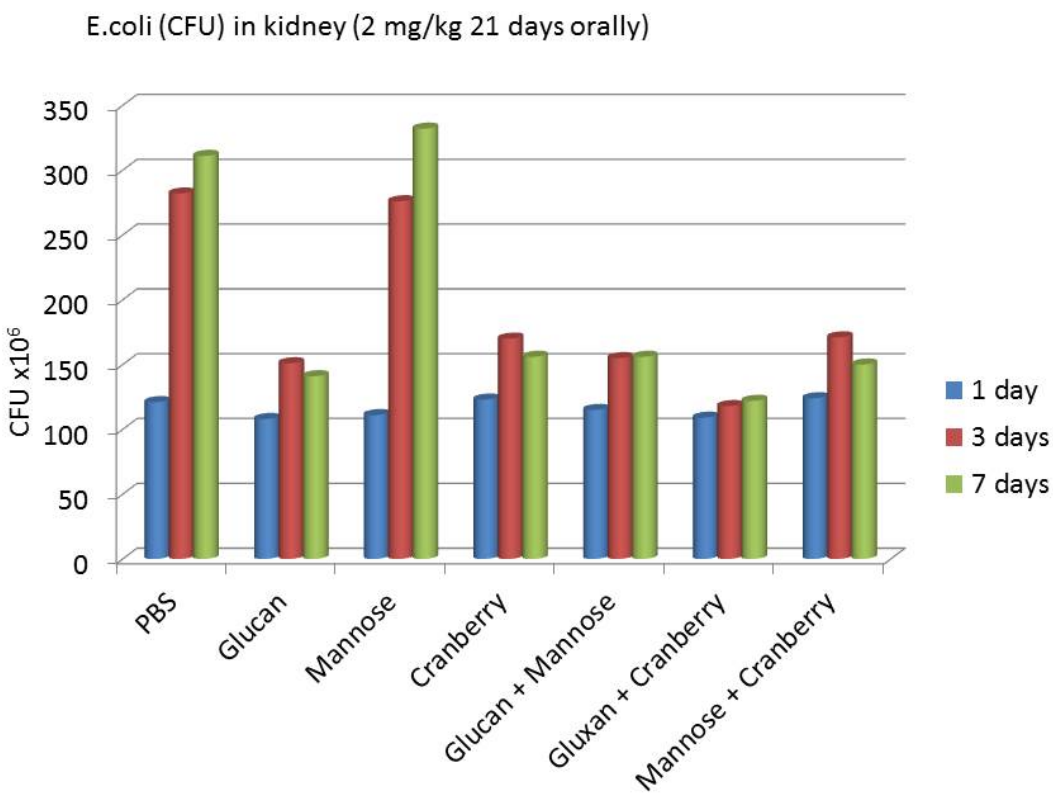
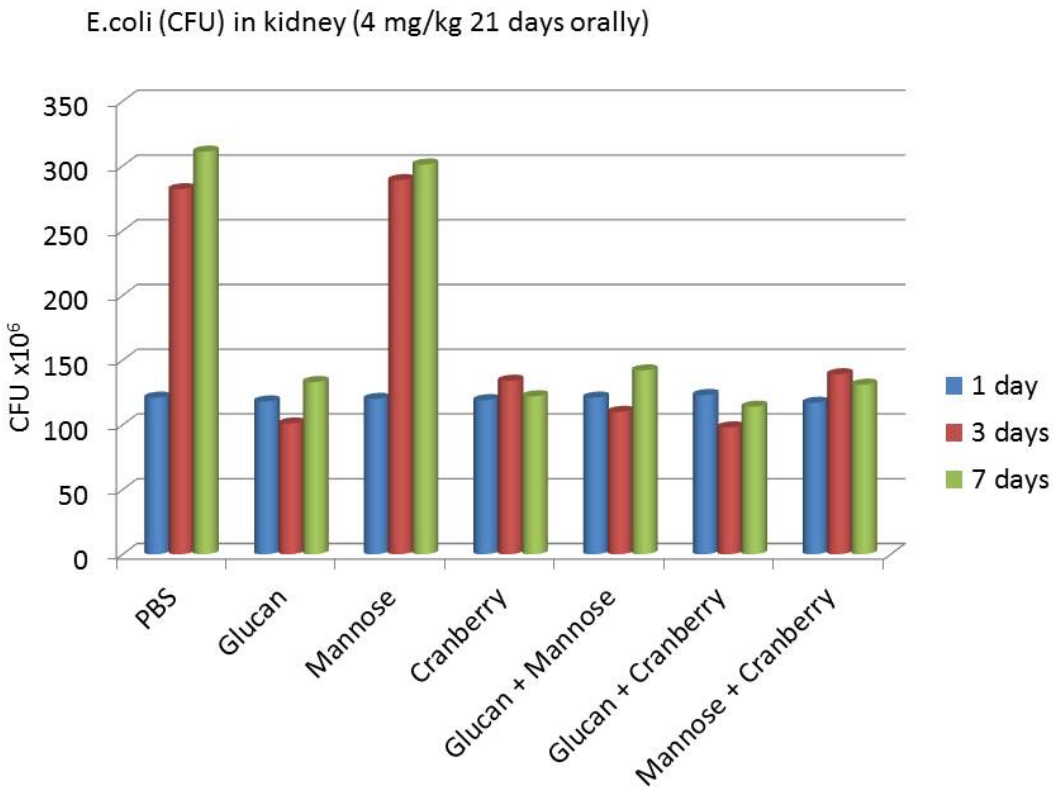

E.coli (CFU) in kidney (2 mg/kg 21 days orally)
CFU x10^6
350
300
250
200
150
100
50
0
PBS
Glucan
Mannose
Cranberry
Glucan + Mannose
Gluxan + Cranberry
Mannose + Cranberry
1 day
3 days
7 days

Figure 8


E.coli (CFU) in kidney (4 mg/kg 21 days orally)
CFU x10^6
350
300
250
200
150
100
50
0
PBS
Glucan
Mannose
Cranberry
Glucan + Mannose
Glucan + Cranberry
Mannose + Cranberry
1 day
3 days
7 days