

A study of therapeutic effect of D-mannose on urinary infection caused by *Escherichia coli*

Abstract

The urinary tract infections (ITU) affect a large proportion of the world population and are among the most common infectious diseases.¹ An estimate reveals that almost one in two women will suffer from this condition at least once in his life.² In addition, a number of individuals affected, will face multiple recurrent infections.

A disturbing fact is the high rate of recurrence of symptoms following treatment with antibiotics, even among patients suffering from an uncomplicated urinary tract infection.¹ The problem of antibiotic resistance has prompted researchers to find natural alternatives to treat urinary tract infections caused by *Escherichia coli* (*E. coli*) uropathogen; among these alternative: D-Mannose. D-Mannose is a natural sugar; it is present in various foods, and binds to *E. coli*, which is then discharged in urine.

The purpose of this research is to prove the efficiency of D-Mannose and provide an approach to the mean duration of treatment by performing tests on laboratory rats, by provocation of UTI contaminating rats by different ways then, administration of D-Mannose orally. A bacteriological examination of urine was carried out and the interpretation of results was based on the sterility of the culture media.

Keywords: *E. coli*, uropathogen, urinaryinfection, d-mannose, natural treatment

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Introduction

To demonstrate experimentally the efficiency of D-Mannose treatment on urinary tract infections caused by *E. coli* bacteria, several works have been published in this context. One study showed that D-Mannose was as effective as antibiotic prophylaxis to prevent recurrent urinary tract infections.³ In 1979, Aronson et al.⁴ demonstrated for the first time the ability of carbohydrates to protect animals against the urinary infections, co-administration of the reduced D-Mannose to 67% infection rate. The work of J. W. Janekta & S. J. Hultgren⁵ also demonstrated the efficiency of D- Mannose and say the glucid blocks the adhesion of *E. coli* to cells of the bladder; after drug administration by mice with chronic urinary tract infection, the bacteria levels fell much faster than in the second group of mice treated with antibiotic treatment. In another study,⁶ the urinary tract of the rats was inoculated with *E. coli*, in one day the level of bacteria in the urine of animals receiving D-Mannose is significantly lower.

Experimental study

This experience is based on the experimental confirmation of the action of D-Mannose on *E. coli* uropathogen. We conducted tests on Wistar rats, which are genetically very close to humans. For this we have chosen eight rats: four males and four females witch one witness for each sex. Those weighing is between 190-210g. These Wistar albino are housed in separate cages in transparent plastic with a length of 50cm and width of 35cm and a height of 20cm, with personal identification of each rat (mentioning: sex, weight the cage number)

First, a bacteriological examination of urine was performed to prove that the eight rats were suffering from any pathogen. Then we proceeded to the contamination of six rats leaving the two witnesses (RT♂ and RT♀). The bacterial suspension preparation called *E. coli*

strains uropathogen already identified by the laboratory. These strains were added to large doses of saline to keep their vitality. In step of contamination, we diversified the mode of contamination in the aim to note the most reliable method to contamination.

For this we:

1. Ejected the solution of *E. coli* R1♂ - 2R♂ - R3♂ rats.
2. Use the method to the taint of the genital apparatus R2♀ rat.
3. Used the feeding means, that is to say swallow oral solution of *E. coli* to R1♀ - R3♀ rats.

We left on for 24hours. After collection of urine, a bacteriological urine analysis was done to our samples. Interpretation of results is based on the thrust of the bacteria on the streaks.

We noticed that R1♂ - R2♂ - R3♂ - R2♀ rats were infected with *E. coli* due to the presence of bacteria on the three stripes. The review of the presence of *E. coli* is detected with the naked eye by the specificity of these colonies rounded to salmon color on the middle Hecktoen (Figures 1-4).⁷ The R1♀-R3♀ rats were not contaminated (Figure 5) (Figure 6) it can be explained by following reasons:

- a. The unreliability of contamination route (oral).
- b. The body's defenses mechanisms are sufficient to neutralize the bacteria.
- c. Gastric acidity kills the bacteria before reaching the urinary tract.

To ensure the presence or absence of *E. coli*; we also carried out the biochemical identification of *E. coli* on a series of biochemical tests: Mannitol (Figure 7), TSI (Tri Sugar Iron) (Figure 8) Simmons citrate (Figure 9), and Urea-Indole (Figure 10).



Figure 1 Culture R1♂ after contamination



Figure 2 Culture R2♂ after contamination.



Figure 3 Culture R3♂ after contamination.



Figure 4 Culture R2♀ after contamination



Figure 5 Culture R1♀ after contamination.

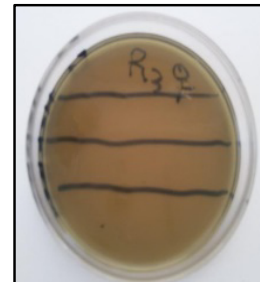


Figure 6 Culture R3♀ after contamination.



Figure 7 Mannitol after incubation



Figure 8 TSI after incubation.



Figure 9 Citrate of Simmons after incubation.



Figure 10 Uree-indole after incubation.

The treatment

To demonstrate the action of D -Mannose in the treatment of urinary infection caused by *E. coli*, we have converted the appropriate dose for the rat following the effective dose for humans: 3g for adults is given every 2 h whose average weight is 60kg adult and 200g rats. We administered the dose of D-Mannose 0.01g orally six times a day with 2hours interval. Then we performed bacteriological examinations of control urine to see its action. The results of bacteriological examination of urine are represented by the following figures (Figures 11-15 for R1♂ and 16- 19 for R2♂). From the different tests on guinea pigs and based on bacteriological examinations, we successful on these findings:

- We have seen the death of rats and R3♂ R2♀ by urinary retention that can be caused by urinary tract infection.⁸
- We noticed a R2♂ diarrhea in 02 days that is due to the adverse effect of D-Mannose³
- The results of bacteriological examination to assess the levels of

bacteria per unit CFU/ml depending on their push on the ridges, the results are shown in Table 1.

Table 1 The results of bacteriologic exam

Jours	R1♂	R2♂
1 st day	$10^3 < \text{Bacteria level} < 10^8$	Bacteria levels $> 10^5$
2 nd day	Bacteria level $< 10^3$	$10^3 < \text{Bacteria levels} < 10^5$
3 rd day	Bacteria levels $< 10^3$	Bacteria levels $< 10^5$
4 th day	Bacteria levels $< 10^3$	
5 th day	0	

Regarding R1♂ R2♂ and guinea pigs, we found fewer colonies over days (Figures 11-15 for R1♂ and Figures 16-19 for R2♂). For R1♂ the bacterium rate is 10^3 CFU/ml in the 2nd, 3rd and 4th day but the number of colonies estimated by the naked eye in the 2nd day $> 3^{\text{rd}}$ day $> 4^{\text{th}}$ day; from the fourth day the number of colony is almost nil.

Decreasing the number of colonies is probably explained by the effect of D -Mannose taken by rats after infection.

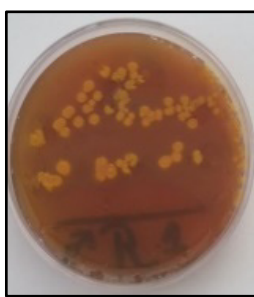


Figure 11 Culture R1♂ the 1st day of traitement.



Figure 12 Culture R1♂ The 2nd day of traitement.

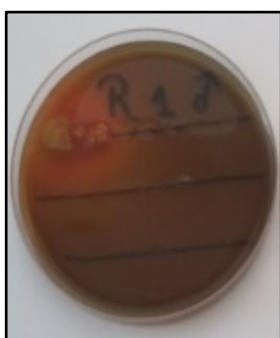


Figure 13 Culture R1♂ the 3rd of traitement.



Figure 14 Culture R1♂ the 4th day of traitement.



Figure 15 Culture R1♂ the 5th day of traitement



Figure 16 Culture R2♂ the 1st day of traitement.



Figure 17 Culture R2♂ The 2nd day of traitement



Figure 18 Culture R2♂ the 3rd of traitement.

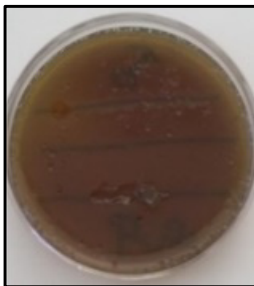


Figure 19 Culture R2♂the 4th day of traitement.

We noticed that from the 4th day, a total cure of R2♂ is observed (Figure 19). R1♂ for a full recovery occurred only from the 5th day of treatment (Figure 15). These results reflect the effect of D -Mannose on the neutralization of *E. coli* and show that the average duration of treatment is five days.

Conclusion

A new therapeutic approach provides a simple and effective solution to the problem lie in treating urinary infection caused by *E-coli* using D-Mannose, Experimental tests showed that its action is about five days. D-Mannose binds to molecules of E-coli that are then discharged with the urine; it prevents the adhesion of certain bacterial strains (*E. coli*) to uro epithelial bladder cells.⁹ It allows treating almost 90% of urinary tract infections, without thereby killing the bacteria.

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None.

Conflict of interest

Author declares there is no conflatae of interest towards this manuscript.

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