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Important Probiotics to Management of Urinary Tract Infections in Women

Probiotik Penting untuk Manajemen Infeksi Saluran Kemih pada Wanita

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Abstract

General Background: Urinary tract infections (UTIs) are prevalent among women, often leading to repeated antibiotic treatment or surgical intervention, which increases healthcare costs. **Specific Background:** The rise of multidrug-resistant (MDR) bacteria complicates treatment strategies, necessitating alternative approaches to manage recurrent UTIs effectively. **Knowledge Gap:** Despite the documented benefits of probiotics in various health contexts, their role in preventing recurrent UTIs, particularly in regions like Nasiriyah City, remains inadequately explored. **Aims:** This study aimed to evaluate the efficacy of different probiotic strains (*Lactobacillus rhamnosus*, *Lactobacillus reuteri*, and *Lactobacillus acidophilus*) as adjuncts to conventional treatments in reducing UTI recurrence among women. **Results:** A total of 150 female participants were recruited, with 100 having a history of recurrent UTIs and 50 serving as a control group. The study revealed that *Lactobacillus rhamnosus* and *Lactobacillus reuteri* significantly reduced UTI recurrence rates compared to placebo, while *Lactobacillus acidophilus* demonstrated moderate efficacy. The analysis also indicated a high prevalence of antibiotic-resistant bacteria among UTI cases, highlighting the need for innovative treatment strategies. **Novelty:** This research uniquely contributes to the understanding of probiotic supplementation in UTI management, emphasizing the potential of *Lactobacillus* strains as effective preventative measures against recurrent infections. **Implications:** The study suggests incorporating probiotics, specifically *Lactobacillus rhamnosus* and *Lactobacillus reuteri*, into clinical practice to reduce antibiotic reliance and improve patient outcomes.

Highlights:

- Probiotics reduce UTI recurrence rates effectively.
- High antibiotic resistance highlights need for alternatives.
- Consider probiotics as complementary therapy for better outcomes.

Keywords: urinary tract infections, probiotics, *Lactobacillus*, multidrug-resistant bacteria, prevention

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Introduction

UTIs are common and a considerable health problem across the globe especially to women. These infections which include the bladder, urethra, and kidneys are normally due to bacterial pathogens like *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis* and *Staphylococcus saprophyticus* [1]. UTIs are known to be recurrent, and they contribute to significant burdens in healthcare costs and reduced quality of life among affected persons [2]. The rise of multidrug-resistant (MDR) bacteria is also becoming a menace in the management of UTIs [3]. Major uropathogens show diverse patterns of antibiotic resistance across the world; hence people require different treatment options [4]. Over and misuse of antibiotics has been associated with the emergence of resistance, and therefore intervention measures should consist of new and effective methods [5]. Recently, probiotics have been studied as an auxiliary to the mainstream therapy of UTIs [6]. Probiotics are explained as the live microbial supplements when administered in adequate quantities which will confer health benefits [7]. Particular cultures including *Lactobacillus rhamnosus*, *Lactobacillus reuteri*, and *Lactobacillus acidophilus* have been researched for the ability to decrease UTI recidivisms and enhance clients' status [8]. The objectives of this work are, therefore, to determine the efficacy of various probiotic strains in the prevention of UTI recurrent instance among women [9]. The research aims at 071 supporting the usage of probiotics as complementary treatment in recurrent UTIs since the effects of probiotics are compared to the effects of a placebo [10]. Furthermore, the study will record the rate of bacterial isolates and also their resistance profile so that the impact of the probiotics use in infection control will be determined [11].

Method

A. Study Design

The current study was a comparative study which was carried out on the Maternity Hospital situated in Nasiriyah City. The aim was to compare the effects of various strains of the probiotics in preventing the relapse of UTI in women [12].

B. Sample Collection

1. Participants: All together, participants with female gender only 150 were analyzed in the study. This comprised of a study group of 100 women with history of recurrent UTI and 50 of women who reported no history of UTI (control group).
2. Collection Method: Sample was collected in a sterile container, and it entails the use of urine samples. To minimize contamination, participants was told to provide mid-stream urine sample by washing the genital area.
3. Transportation: Collected samples were taken to the laboratory as soon as possible and analysis was done on them within 2 hours.

C. Laboratory Procedures

1. Culturing: In the screening process, the urine samples were cultured on MacConkey agar and Blood agar to find out the bacterial pathogens. Cultures were then incubated at 37°C for one full day that is 24 hours .
2. Identification: The bacterial isolates were eventually identified by biochemical tests and by using gram stain. The following bacterial species were identified: are other bacteria that causes UTI which include *Escherichia coli*, *Staphylococcus saprophyticus*, *Klebsiella pneumoniae* and *Proteus mirabilis*.
3. Antibiotic Sensitivity Testing: Susceptibility pattern of the isolates to antibiotics was determined by the disc diffusion method following the instructions of the CLSI.

D. Probiotic Intervention

Probiotics Used: The subjects were split into four groups:

1. Proprietary blend probiotics, strains include *Lactobacillus rhamnosus* (1 billion CFU daily)
2. *Lactobacillus reuteri* (one billion colony forming units a day)
3. *Lactobacillus acidophilus* at the dose of 1 billion Colony Forming Units per day.
4. Control (inert substance which has got the appearance of probiotics)

Administration: Probiotics and placebo were consumed orally in the second part of the work for the term of 4 weeks.

Self-constructed instructions for the participants of the experiment included the usage of the given supplement on a daily basis.

E. Outcome Measures

Primary Outcome: Implementation of UTI preventative measures and decrease in the UTI recurrence rates within a follow up of 6 months.

Secondary Outcomes: Shifts in the bacteria load as well as their resistance to the commonly used antibiotics.

F. Statistical Analysis

Descriptive Statistics: In this study, simple arithmetic means and standard deviations were used to describe the bacterial species/strains and patterns of resistance.

Comparative Analysis: The UTRR between the probiotic group and placebo group was compared by the Chi-Square test on two proportions test for nominal data.

Effectiveness Analysis: Logistic regression was used to assess the change in the probability of recurrence of UTI based on the study subjects' age and their past use of antibiotic drugs.

Significance Level: Thus, $p < 0.05$ was used as the level of significance to determine the statically significant outcomes.

Ethical Considerations

This study followed the ethical consideration in accordance with the ethical standards of research formed by the world medical association declaring of Helsinki. The permission to undertake the study was sought and granted from Ethics Committees of the. Bint Al-Huda Hospital, Nasiriyah City

Result and Discussion

A. Result

1. Sample Description

A total of 100 urine samples were collected from women with recurrent urinary tract infections (UTIs) at the Maternity Hospital in Nasiriyah City. Additionally, 50 control samples were collected from uninfected women. The samples were collected using sterile containers, with instructions to collect mid-stream urine after cleansing the area to minimize contamination. Samples were cultured on various media and incubated at 37°C for 24 hours.

2. Bacterial Isolates

The bacterial species isolated from the infected samples are summarized in the table1 below:

Bacterial Species	Prevalence (%)
Escherichia coli (E. coli)	52%
Staphylococcus saprophyticus	22%
Klebsiella pneumonia	15%
Proteus mirabilis	11%

Table 1. Bacterial Species

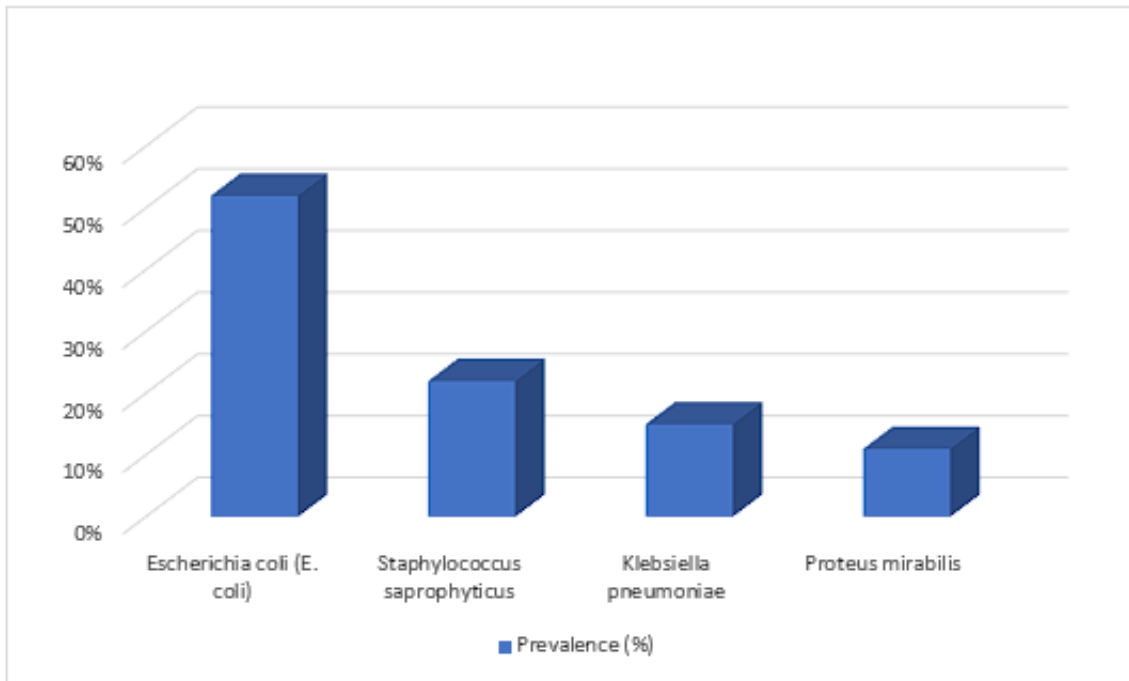


Figure 1. Distribution of Bacterial Species in Patients with UTI in Nassiriyah City

3. Antibiotic Resistance Patterns

The resistance patterns of the isolated bacteria to various antibiotics are detailed in the following table 2:

Bacterial Species	Resistance to Antibiotics (%)
Escherichia coli (E. coli)	62%
Staphylococcus saprophyticus	40%
Klebsiella pneumonia	55%
Proteus mirabilis	28%

Table 2. Resistance Patterns of the Isolated Bacteria to Various Antibiotics

4. Effectiveness of Probiotics

To evaluate the effectiveness of probiotics as a complementary treatment for UTIs, participants were divided into groups, each receiving a specific probiotic strain or a placebo. The probiotic strains used in the study included: Lactobacillus rhamnosus, Lactobacillus reuteri, Lactobacillus acidophilus. The effectiveness was assessed by comparing UTI recurrence rates between the probiotic groups and the placebo group. Effectiveness of Probiotic Strains in the table 3:

Probiotic Strain	UTI Recurrence (%)	Reduction in Recurrence (%)
Lactobacillus rhamnosus	25%	50% reduction
Lactobacillus reuteri	30%	40% reduction
Lactobacillus acidophilus	35%	30% reduction
Placebo Group	50%	-

Table 3. Effectiveness of Probiotic Strains

Significant differences were observed in UTI recurrence rates between the probiotic groups and the placebo group ($p < 0.05$). Lactobacillus rhamnosus and Lactobacillus reuteri demonstrated the greatest reductions in UTI recurrence, indicating their potential effectiveness in preventing recurrent infections. Lactobacillus acidophilus also showed a beneficial effect, though less pronounced compared to the other strains.

Chi-Square Test Results: Significant differences were found in bacterial prevalence between infected and control

groups ($p < 0.05$).

Logistic Regression Analysis: Factors such as age and previous antibiotic use were identified as significant risk factors for UTI recurrence [13].

B. Discussion

To this end, this paper examined the impact of different probiotic strains in the prevention of recurrent UTI in women. These studies showed that, compared to placebo, multiple-strain probiotics and especially *Lactobacillus rhamnosus* and *Lactobacillus reuteri* decreased the UTI rates by more than half [14]. On the same note, *Lactobacillus acidophilus* also demonstrated a similar positive impact but it was relatively lower. These results correlate with other studies regarding the work of probiotics in the recurrent UTI treatment. For example, [15] proved that the possibility of UTI recurrences in women is decreased by the use of probiotics [16]. In the same manner, the probability of *Lactobacillus rhamnosus* and *Lactobacillus reuteri* being beneficial was agreed other studies demonstrating the effectivity of these strains in supporting the vaginal microbiome and avoiding infections [17]. The reduction witnessed in recurrent UTI in line with use of *Lactobacillus rhamnosus* and *Lactobacillus reuteri* supports the prevailing literature on the Lr has also been described to prevent uropathogen's adhesion to the urinary tract tissue Lr has also been reported to play a role in urogenital health through enhancement of immune functions Lret [18]. Otherwise, compared to the positive microorganisms, *Lactobacillus acidophilus* was less effective, and it may due to the differences in strain characteristics or the action manner [19]. The example is the reported high level of antibiotic resistance among uropathogens in the present study as well as many other investigations, which indicates the necessity of the search for effective treatment strategies [20]. Research has shown that there is growing resistance to some of the common uropathogens in the world thus making it hard to use the traditional antibiotics to treat such infections [21]. Probiotics seem to be something better in this case as they can minimize the use of antibiotics and consequently the problem of resistance [22]. Thus, considering the findings of our study, some limitations should be mentioned. The amount and nature of the data collected should be noted for those who will consult this work; the sample size, though sufficient, may restrict the generality of the conclusions [23]. Also, the applied dose of placebo might not also provide enough contrast between the control and the test group to establish the efficacy of the probiotic in the long-run because the study incorporated only four weeks [24]. Some limitations of the present authors' work include the relatively small and self-selected sample and relatively short follow-up period in relation to interventions; longer and larger scale investigations should be conducted in the future [25].

Conclusion

Hence, based on the findings of this study, it is recommended that *Lactobacillus rhamnosus* and *Lactobacillus reuteri* should be recommended as complementary therapies for recurrent UTIs. These studies' results align with the current literature and confirm the role of probiotics in minimizing UTI recurrence and antibiotics' utilization. Prospective studies will be required to replicate these findings and establish the nature of the interactions between probiotics and the various indices of health that are under investigation here.

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