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Research Article

Antimicrobial Effect of *Cyperus rotundus* Tuber Extract on the Microorganisms of the Urinary Tract Infection

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Abstract

Background: Medicinal use of plants dates to long back in the history of the human beings and has recently gained a great deal of importance in treating different diseases including the urinary tract infection.

Objectives: In the present study the effects of *Cyperus rotundus* tuber extract on the microorganisms of the urinary tract infection was investigated.

Materials and Methods: Ethanol extracts of *Cyperus rotundus* tuber was prepared by maceration. Antimicrobial effect of these extracts on the isolated strains was determined by disk diffusion and broth microdilution methods.

Results: Results revealed a growth inhibitory concentration greater than 0.5 mg/ml of the ethanol extract on all the examined microorganisms of the urinary tract infection.

Conclusions: It was thus concluded that *Cyperus rotundus* has a significant antimicrobial property with a potentially important role in the treatment of the urinary tract infection.

Keywords: *Cyperus rotundus*; Antibactria; Urinary Tract Infection (UTI)

Introduction

Urine is normally sterile; however, it can be subjected to infection by bacteria, viruses, parasites and fungi [1]. Urinary Tract Infection (UTI) is one of the most common infections in all age groups, and when left untreated may result in liver conditions, urinary apparatus disturbances, uremia, and premature birth in pregnant women. UTI is more common in children, pregnant women and diabetic patients [2-5]. Bacterial infection of the urine is one of the most important causes of kidney stone formation [6]. Gram negative bacteria, in particular E. coli, are the most common causes of urinary tract infection [7,8].

Plants have served as medicine since the ancient time [9]. Similar to antibiotics, the antimicrobial effects of medicinal plants have gained a great deal of attention [10,11]. Use of medicinal plants in the past several decades has increasingly turned popular such that a great number of the available medicines are of plant origin [12,13], and medicinal plants are currently being used for the treatment of many diseases including fungal infections [14].

Cyperus rotundus also known as nut grass as a member of the Cyperaceae family is distributed in humid, marshy, warm and moderate environments including Northern Iran with a local name of Teplagh. It is a perennial plant with a 20-40 cm height, long roots with rhizomes and a black shelled tuber with a white and odorous interior. Leaves are numerous, small, linear, dark green and spikelets are reddish brown [15-17]. The rhizome contains essential oil, Saponins, Vitamine C, Polyphenol and Flavonol glycoside [18,19]. *Cyperus rotundus* has had medicinal use in gastrointestinal bloating, stomach burning, stomach ulcers, menstrual periods, kidney problems, headaches and liquid mouthwash [20-22].

Due to the increasing importance of plants in herbal medicine and their low rates of side effects, this study aimed at studying the antimicrobial effect of *Cyperus rotundus* extract on urinary tract infecting microorganisms.

Materials and Methods

Pathogenic microorganisms

Pathogenic microorganisms were isolated from urine samples of urinary tract infected patients [23] and identified by biochemical tests [23,24].

Cyperus rotundus tuber extract preparation

Cyperus rotundus tubers were collected from the agricultural lands of Aznava-Behnamir in Mazandaran province of Iran. Extracts were prepared by maceration or wetting by ethanol solution. Tubers were dried in a closed environment with air conditioning, and powdered. A total of 200 grams of the powder was added to 100 ml of ethanol and incubated for 48 h, and then filtered through a sterile paper filter. This filtered extract was then dried by incubation at 40°C.

Antimicrobial activity of the tuber extract

Strain sensitivity was determined by both disc diffusion and broth microdilution methods. Initially, suspensions of 0.5 McFarland (1.5×10^8 CFU/ml) were prepared [26].

In the disc diffusion method, using a sterile swap, suspensions were grown on Muller Hinton agar medium, while Candida albicans was grown on Saboro dextrose agar medium. Sterile blank discs were placed in plates containing different concentrations of the tuber extract and then placed on agar plates containing microorganisms. These plates were incubated at 37°C for 24 h, and then subjected to measurements of the zone of growth inhibition [17].

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Table 1: Results of disc diffusion test.

Microorganism	Diameter of zone of growth inhibition (mm) at 25mg/ml of the extract
Staphylococcus aureus	15
Staphylococcus epidemidis	12
Staphylococcus saprophyticus	15
Micrococcus	12
Esherichia coli	14
Enterococcus faecalis	14
Proteus	15
Klebsiella pneumoniae	12
Pseudomonas aeroginosa	15
Citrobacter	15
Candida albicans	11

In the broth microdilution method, tubes containing Muller Hinton broth medium and Saboro Dextrose medium containing 0.5-20 mg/ml of tuber extract to a total volume of 1 ml were prepared and inoculated with 100 µl of 0.5 McFarland suspension. A solution of 0.05 mg/ml of the extract was also included as negative control. MIC values were determined after 24 h of incubation at 37°C [28].

Results

A total of five Gram positive bacteria including *Staphylococcus aureus, Staphylococcus epidemidis, Staphylococcus saprophyticus, Enterococcus faecalis,* Micrococcus and six different strains of Gram negative bacteria including *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus, Pseudomonas aeroginosa, Citrobacter* and one yeast strain the *Candida albicans* were isolated from urinary tract infected samples, and their sensitivity to tuber extract was determined.

Strain sensitivity to *cyperus rotundus* tuber extract

In the disc diffusion method, zone of growth inhibition appeared at a minimum inhibitory concentration of 25 mg/ml for all UTI strains (Table 1).

In the broth microdillution method, the MIC value for all bacterial strains was at a concentration of 0.2 mg/ml, while that of *Candida albicans* was determined at 0.5 mg/ml. A greater sensitivity was observed for *Staphylococcus aureus*, *Staphylococcus saprophyticus, Pseudomonas aeroginosa* and Citrobacter with a MIC value at 0.5 mg/ml (Table 2).

Discussion

In the present study, the antimicrobial effect of *Cyperus rotundus* tuber ethanolic extract on urinary tract infecting microorganisms was investigated. Our collective results revealed that the extract did possess an antimicrobial property against all the examined UTI microorganisms. The MIC value for all bacterial strains was greater than 0.2 mg/ml, and *Candida albicans* had the greatest MIC value at 0.5 mg/ml. *Staphylococcus saprophyticus, Pseudomonas aeroginosa* and Cirobacter were the most sensitive strains.

Cyperus rotundus tuber extract has been shown to possess antimicrobial activity [29], while its inhibitory effect against *Streptococcus pyogenes* growth was demonstrated by Mehta et al. [30].

Table 2: MIC values of the ethanolic extract of *Cyperus rotundus* for microorganisms.

Microorganism	MIC value (mg/ml)
Staphylococcus aureus	0.1
Staphylococcus epidemidis	0.2
Staphylococcus saprophyticus	0.1
Micrococcus	0.2
Esherichia coli	0.2
Enterococcus faecalis	0.2
Proteus	0.2
Klebsiella pneumoniae	0.2
Pseudomonas aeroginosa	0.1
Citrobacter	0.1
Candida albicans	0.5

On the other hand, *Cyperus rotundus* whole plant extract has also been shown to be ineffective against strains of *E. coli, Pseudomonas aeroginosa and Salmonella typhi* [31]. Eltayebi et al. determined a MIC value of 12.5 mg/ml for their bacterial strains [17], while the maximum MIC value in our study was determined to be 0.5 mg/ml.

In conclusion, *Cyperus rotundus* extract possesses antimicrobial effect and thus inhibits the growth of urinary tract infected microorganisms and thus has a great potential in treating patients with UTI.

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MD contributed in performing laboratory experiments. SM conceived the idea. SI prepared the manuscript.

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