



Antibacterial activity of Cashew (*Anacardium occidentale* L.) apple juice against antibiotic resistant urinary tract pathogens

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ABSTRACT

Antibiotic resistance in pathogenic microorganisms is a serious threat to successful therapy. The aim of the present study was to determine antibacterial efficacy of condensed cashew apple (*Anacardium occidentale* L.) against antibiotic resistant urinary tract pathogens. The juice was extracted from ripe cashew apples and concentrated to 1/10th of original volume. Inhibitory activity of condensed cashew apple juice was tested against five urinary tract pathogens by Agar well diffusion assay. Among Gram negative and Gram positive test bacteria, *Pseudomonas aeruginosa* and *Enterococcus faecalis* were inhibited to higher extent respectively. Least inhibitory activity was observed in case of *Escherichia coli*. Antibacterial efficacy of condensed cashew apple juice could be attributed to the presence of inhibitory components present in it. Further studies on separation of bioactive components and determination of their inhibitory activity against uropathogens are to be carried out.

Key words: *Anacardium occidentale*, Cashew apple juice, Urinary tract infection, Agar well diffusion, Antibiotic resistance

INTRODUCTION

Anacardium occidentale L. (Cashew) belonging to the botanical family Anacardiaceae is a native of Brazil. It is one among the most important plantation crops in various countries such as India, Brazil, Nigeria and Vietnam. The plant is grown for the nuts (true fruit). The nuts have an exclusive fine taste and a commercial importance. The edible cashew apple (the thick receptacle or 'false fruit' to which the cashew nut or true fruit is attached) possess high nutritive values because of its high vitamin C content, minerals such as calcium, phosphorus, iron etc. The cashew apple is used in food industries as well as in breweries. It can be consumed as natural and also as juice, pulp, wine etc [1,2,3]. The cashew apple is shown to exhibit several bioactivities [4-11]. In the present study, we report the inhibitory efficacy of condensed cashew apple juice against antibiotic resistant bacterial isolates recovered from urinary tract infection (UTI).

MATERIALS AND METHODS

Collection of cashew apples and extraction of juice: The ripe cashew apples were collected during June 2013 at Maragalale, Thirthahalli (Taluk), Shivamogga (district), Karnataka (State), India. The cashew apples were washed well with clean water. The cashew apples were cut into small pieces and the juice was extracted using a blender (with no addition of water). The juice was filtered through 4-fold sterile muslin cloth. The juice was then condensed to 1/10th of the original volume [11].

Test bacteria: The antibacterial efficacy of condensed cashew apple juice was tested against a panel of five bacteria viz., *Staphylococcus aureus*, *Enterococcus faecalis*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Klebsiella pneumoniae*. These bacteria were the clinical isolates recovered from urinary tract infection and were found to be antibiotic resistant. Table 1 presents the antibiotic resistance profile of the test bacteria.

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Antibacterial activity of cashew apple juice: In order to determine antibacterial efficacy of condensed cashew apple juice, we performed Agar well diffusion assay. The test bacteria were inoculated into sterile Nutrient broth (HiMedia, Mumbai) tubes and incubated for 24 hours at 37°C. The broth cultures were swabbed aseptically on sterile Nutrient agar (HiMedia, Mumbai) plates and wells of 6mm diameter were punched in inoculated plates with the help of sterile cork borer. The condensed cashew apple juice and Streptomycin (standard antibiotic, 1mg/ml) were added to respectively labeled wells. The plates were incubated aerobically at 37°C for 24 hours and the zones of inhibition formed around the wells were measured using a ruler [11].

Statistical analysis: The experiment was performed in triplicates. The results are represented as Mean±Standard deviation (SD).

RESULTS AND DISCUSSION

Table 2 shows the antibacterial efficacy of condensed cashew apple juice against antibiotic resistant clinical isolates recovered from UTI. The absence of bacterial growth around the wells was considered positive for antibacterial activity. The bacterial isolates displayed varied susceptibility to condensed cashew apple juice. High and least inhibitory activity of condensed cashew apple juice was observed in case of *P. aeruginosa* and *E. coli* respectively. *P. aeruginosa* and *E. faecalis* were inhibited to higher extent among Gram negative and Gram positive bacteria respectively. Standard antibiotic showed higher inhibitory activity against bacterial isolates.

UTIs are among the most common infectious diseases and remain a major public health problem in terms of morbidity and financial cost. UTIs are common in all age groups of both the sexes. The occurrence of UTI is more common in female than male. UTIs can be classified on the basis of symptoms (asymptomatic or symptomatic), severity (complicated or uncomplicated) and the site of infection. Conditions such as malnutrition, lack of hygiene and low socio-economic status are often associated with UTIs and are usually found in rural settings. Most common bacterial agents which are implicated in *E. coli*, *P. aeruginosa*, *E. faecalis*, *S. aureus*, *S. saprophyticus*, *K. pneumoniae*, *Proteus* sp. and others. Among these, *E. coli* is the major aetiological agent in most cases of UTI and represents about 75%. UTIs can be caused by a single species or more than one species (polymicrobial). Effective management of bacterial UTIs is based on identification of the type of organisms and the selection of an effective

antibiotic to target the organisms. However, overuse and abuse of antibiotics resulted in the development of resistant strains of urinary tract pathogens. The prevalence of these antibiotic resistant urinary tract pathogens is increasing worldwide and is making the therapy more complicated [12-16].

Plants have been considered as a tremendous source of therapeutic agents since time immemorial. It is estimated that >80% of world's population rely on traditional medicine to meet the primary healthcare needs. Plants are an integral part of traditional medicine and are being utilized worldwide for the treatment of various types of ailments. Plants have been extensively used in traditional systems of medicine such as Ayurveda, Unani, Homeopathy and Sidda. Plants provide lead compounds for the development of novel drugs. Vast majority of conventional drugs such as aspirin, quinine, digoxin, morphine etc. have been derived from plants [17-20]. It has been found that cashew apple possess several biological activities. It is shown to exhibit several biological activities such as antimicrobial [4,6,9], antioxidant [8,10], antitumor [5] and antimutagenic activity [7]. In a previous study, we reported the efficacy of condensed cashew apple juice to inhibit clinical isolates of *Staphylococcus aureus* and *Streptococcus mutans* isolated from burn and dental caries [11]. In the present study, condensed cashew apple juice was found to exhibit inhibitory activity against antibiotic resistant bacterial isolates of UTI. Plants and plant based formulations have been traditionally used for treatment of UTIs in various parts of the world [21,22,23].

It has been found that many plants possess antibacterial activity against urinary tract pathogens [24-28]. Inhibitory activity against urinary tract pathogens of plants such as *Barringtonia acutangula* [25], *Cassia auriculata* [29], *Ballota acetabulosa* [27], *Ziziphora clinopodioides* [30], *Anisomeles indica* [31] and *Teucrium polium* [32] have been investigated.

CONCLUSION

The condensed cashew apple juice was found to exhibit inhibitory activity against drug resistant urinary tract pathogens. The antibacterial efficacy could be ascribed to the presence of bioactive principles which are to be isolated and tested for inhibitory activity against urinary tract pathogens. The cashew apple juice can be a potential remedy for UTI.

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Table 1: Urinary tract isolates and antibiotics against which the isolates are resistant

Isolate	Antibiotic
<i>E. coli</i>	Ampicillin, Norfloxacin, Amoxicillin, Cefuroxime, Cotrimazole, Cefazolin, Aztreonam, Cefpirome, Imipenem
<i>K. pneumoniae</i>	Ampicillin, Norfloxacin, Amoxicillin, Cefuroxime, Cotrimazole, Cefazolin, Aztreonam, Cefoperazone, Imipenem
<i>P. aeruginosa</i>	Gentamycin, Amikacin, Ceftazidime, Ciprofloxacin, Tobramycin
<i>S. aureus</i>	Ampicillin, Gentamycin, Norfloxacin, Penicillin
<i>E. faecalis</i>	Ampicillin, Gentamycin, Norfloxacin, Penicillin

Table 2: Inhibitory efficacy of condensed cashew apple juice on urinary tract isolates

Isolate	Zone of inhibition in cm (Mean±SD)	
	Cashew apple juice	Standard
<i>E. coli</i>	1.2±0.0	3.4±0.2
<i>P. aeruginosa</i>	2.2±0.2	3.5±0.3
<i>K. pneumoniae</i>	1.8±0.1	3.0±0.2
<i>S. aureus</i>	1.6±0.2	3.8±0.1
<i>E. faecalis</i>	1.8±0.0	3.0±0.2

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