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Efficacy of steam distillates of *Coscinium fenestratum* and *Curcuma aromatica* against bacteria causing food poisoning

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ABSTRACT

Foodborne illnesses are caused by eating food or drinking beverages contaminated with bacteria, parasites, or viruses. The present investigation highlights the efficacy of steam distillates of two plants namely *Curcuma aromatica* and *Coscinium fenestratum* against bacteria causing food poisoning. A simple method has been employed to collect steam distillate of these two plants and its antibacterial activity was assessed in liquid media. The results obtained were suggestive that the steam distillates are potent enough to inhibit test bacteria. More inhibition of test bacteria was observed in case of *C. aromatica* when compared to *C.fenestratum*. The results are in justification with the folklore use of these two plants as remedy for various illnesses.

KEYWORDS

Steam distillate;
Curcuma aromatica;
Coscinium fenestratum;
Antibacterial activity;
Food poisoning.

INTRODUCTION

Foodborne illnesses are caused by eating food or drinking beverages contaminated with bacteria, parasites, or viruses. Foodborne illnesses can cause symptoms that range from an upset stomach to more serious symptoms, including diarrhea, fever, vomiting, abdominal cramps, and dehydration. Some of the bacterial representatives causing food poisoning are *Escherichia coli, Salmonella typhi, Staphylococcus aureus, Bacillus cereus, Vibrio cholerae, V.parahemolyticus, Clostridium perfringens, Clostridium tetani, Campylobacter* etc.[1]. *Coscinium fenestratum* belongs to the family Menispermaceae and is a critically endagered dioecious medicinal liana found in Western ghats of India. The stem of the plant is used in curing several diseases and disorders like diabetes, wounds and ulcers, fever, jaundice, snake bite, piles etc in ethnomedicine. The chief constituent of *Coscinium* is the yellow crystalline alkaloid, berberine. *Curcuma aromatica* belongs to the family Zingiberaceae. It is recognized as a medical herb with strong antibiotic properties. The rhizome is used to treat several types of ailments in the body including cancer. It contains aromatic volatile oils that possess several important physiological functions[2]. Much information is not available on the efficacy of steam distillates of *Curcuma aromatica* and *Coscinium fenestratum* against bacteria. Thus, the present study was carried to reveal the potential of steam distillates of two plants used in traditional medicine namely *Curcuma aromatica* and *Coscinium fenestratum* against bacteria causing food poisoning.

MATERIALS AND METHODS

Extraction by steam distillation

A simple laboratory quick-fit apparatus with a 1000ml distilling flask, a condenser, and a receiving

vessel, was used for the steam distillation. A known weight of (100 grams) air-dried and powdered plant material was subjected to steam distillation in the assembly. When heated up, the plant cells release their components and some of them are volatilized and carried by the steam. The volatile components were collected into the receiving flask during 3 hours of steam distillation[3,4]. The distillates were transferred into clean containers and stored in refrigerator until use.

Screening for antibacterial activity

Gram positive and Gram negative bacteria causing food poisoning namely *Bacillus cereus, Staphylococcus aureus, Escherichia coli* and *Salmonella typhi* were used as target bacteria. Test tubes containing sterile Nutrient broth were aseptically inoculated with the pure cultures of target bacteria maintained on nutrient agar slants and incubated at 37^0C for 24 hours. The broth cultures of test bacteria obtained after incubation were used for inoculation. The antibacterial activity of steam distillates was tested in liquid nutrient media[5] with minor modifications. The nutrient broth containing known volume of steam distillate were sterilized by autoclaving and were inoculated with standardized volumes of 24 hours old broth cultures of test bacteria followed by incubation at 37^0C for 24 hours. A set of nutrient broth tubes inoculated with bacterial cultures was kept as control without adding steam distillates. After incubation, the contents in the tubes were mixed thoroughly using vortex mixer and the optical density was measured by spectrophotometer at a wavelength of 560 nm as a guide to microbial growth. The whole set of experiments was performed in triplicate, taking the means to get reliable results.

RESULTS AND DISCUSSION

The result of antibacterial activity of steam distillates of *C.aromatica* and *C.fenestratum* is given in the TABLE. Among distillates tested, *C.aromatica* was found to exert marked antibacterial activity when compared to *C.fenestratum*. In case of *C.fenestratum*, only *S.typhi* was found to be affected to more extent (32.35% inhibition) followed by *B.cereus* (12.36% inhibition), *E.coli* (12.27% inhibition) and *S.aureus* (10.18% inhibition). In case of *C.aromatica*, more inhibition was recorded in case of *S.typhi* (42.64% inhibition) followed by *E.coli* (40.43% inhibition), *B.cereus* (18.90% inhibition) and *S.aureus* (17.90% inhibition). It was found that Gram negative bacteria are affected more when compared to Gram positive bacteria.

TABLE 1 : Antibacterial activity of steam distillates in liquid media showing reduction in growth in comparison with control

Steam distillate	Optical density at 560nm			
	E.coli	*B.cereus*	*S.aureus*	*S.typhi*
Control	0.277	0.275	0.324	0.340
Coscinium fenestratum	0.243 (12.27)	0.241 (12.36)	0.291 (10.18)	0.230 (32.35)
Curcuma aromatica	0.165 (40.43)	0.223 (18.90)	0.266 (17.90)	0.195 (42.64)

Results are average of three trials, Values within parentheses are percentage inhibition as compared to control

The antimicrobial activities of the plants may be attributed to to the phytoconstituents present in them such as flavonoids, phenolics and polyphenols, tannins, alkaloids, quinones, triterpenoids, sesquiterpenoids etc. These phytochemicals have shown to possess antimicrobial activities against wide range of microorganisms[6]. Essential oils are valuable natural products, obtained by distillation and other processes, used as raw materials in many fields, including perfumes, cosmetics, aromatherapy, phytotherapy, spices and nutrition[7]. Essential oils are products, generally, of rather complex composition comprising the volatile principles contained in the plants, and more or less modified during the preparation process[8]. Camphor (26.94%), ar-curcumene (23.18%) and xanthorrhizol (18.70%) were found in the essential oil of *C.aromatica*[9]. The most notable volatile oils of *C.aromatica* Salisb. (characterized by GC and GC-MS) being germacrene-D, curzerene, germacrone, curzerenone, xanthorrhizol, curcuphenol and hydroxyisogermafurenolide [10]. Three new sesquiterpenes, isozedoarondiol, methylzedoarondiol and neocurdione, were isolated from *C.aromatica* Salisb[11]. *C.aromatica* ethanol extract, when subjected to mosquito repellent activity, was found to provide biting protection against mosquito and thus it could be applied as an effective personal protection measure against mosquito bites[12]. *C.aromatica* was found to have therapeutic potential for the prevention of hyperglycemia associated diabetic complications[13]. The *C.fenestratum* extract was found to produce strong inhibition zones against *Propionibacterium acnes* and Phytochemical screening revealed the presence of alkaloid which could be responsible for activity[14]. Antibacterial activity of *Coscinium fenestratum* was found

Short Communication

to be mainly due to the presence of berberine[15]. Antibacterial and antifungal activity of ethanol extracts of *C.aromatica* and *C.fenestratum* have been investigated[2].

CONCLUSION

The use of plants to treat diseases, including infectious ones, has been extensively applied by people. The demonstration of antimicrobial activity of steam distillates against both Gram-negative and Gram-positive bacteria is an indication that the plants are potential sources for production of drugs with a broad spectrum of activity. The results of the study also support the traditional application of the plant and suggest the plant extracts possess compounds with antibacterial properties that can be used as antimicrobial agents. The present findings have validated that the steam distillates could be used for the treatment of some microbial infections and diseases caused by these organisms, like UTI, and bacterial food poisoning. Further experiments have to be carried to separate the essential oils from solution and the oil is to be investigated for antibacterial activity.

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