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In vitro Evaluation of antimicrobial activity of *Curcuma longa* rhizome extract against pathogens producing wound infections

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Abstract

Introduction: The aim of the test was to find out the antibacterial efficacy of *Curcuma longa* extracts on pathogens responsible for wound infections.

Methodology: Rhizome extracts was prepared by soxhalation procedures. Alcoholic extract of the *Curcuma longa* was tested against 20 each clinical strains of *Staphylococcus aureus*, *Escherichia coli* and *Pseudomonas aeruginosa* obtained from wound infections by disc diffusion assay. Standard strains and standard drugs were run in parallel.

Results: The alcoholic rhizome extracts of *Curcuma Longa* showed maximum antibacterial activity against the isolates of *Pseudomonas aeruginosa* and *Escherichia coli*. The Gram positive organisms showed diminished sensitivity against alcoholic extracts of *Curcuma longarhizome* extract.

Conclusion: The present study reveals the strong antibacterial potential of the *Curcuma longa* extracts on the gram negative pathogens of wound infection. The topical application of the preparation can be used as potential agents for the control of the antibiotic resistant strains of the wound colonizing and infecting pathogens

Keyword: *Curcuma longa*, Antibacterial, *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, Disc diffusion

Introduction

Multiple drug resistance shown by the pathogens by the indiscriminate use of the commercially used antibiotic is a primary concern in the treatment of infections^[1, 2]. Adverse side effects like hypersensitivity, immune response and allergic reactions are associated with antibiotic use^[3]. Use of the biologically active components obtained from the herbal plants received much

attention against the multidrug resistant organism^[4]. India is the largest producer of medicinal herbs and appropriately called the botanical garden of the world^[5]. In India many research studies still follows use of medicinal plants as the resources for treatment of infectious agents. Several screening studies have been carried out in different parts of the world^[6, 7, 8]. There are several reports on the antimicrobial activity of

different herbal extracts in different regions of the worlds^[9, 10].

Turmeric (*Curcuma longa* L.) is a medicinal plant extensively used in Ayurveda, Unani and Siddha medicine as home remedy for various diseases. *Curcuma longa* L., botanically related to ginger belongs to the Zingiberaceae family^[11]. It is a perennial plant having a short stem with large oblong leaves and bears ovate, fusiform or oblong rhizomes, which are often branched and brownish-yellow in colour. Turmeric rhizome is used as a food additive (spice), preservative and colouring agent and is considered as auspicious and is a part of religious rituals^[12]. The compounds showing yellow colour are three curcuminoid compounds; curcumin, demethoxycurcumin and bisdemethoxycurcumin. Curcumin a yellow bioactive pigment, is the major component of turmeric. It has been shown that curcumin have a wide spectrum of biological activities^[13]. The extracts of turmeric rhizome has recently been used as an insect repellent, antibacterial^[14] antidiabetic^[15] antioxidant,^[16, 17] anti-inflammatory,^[18, 19] anticancer,^[20] antiallergic,^[21] antiprotozoal^[22] and wound healing activity^[23]. The main objectives of the present study was to evaluate the antimicrobial activity of the extracts from rhizome of *Curcuma longa*.

Materials and methods

Extraction of Alcoholic extract: The alcoholic extract of rhizome was made in the ethanol. About 10 grams of rhizome paste were taken and mixed in 50 ml of ethyl alcohol. The mixture was taken into 250 ml sterile conical flasks, plugged with sterile cotton and kept in shaking incubator with the 200 rpm for 24 hour. The solution was filtered through muslin cloth. This process was repeated three times after which a clear aqueous extract of the rhizome was taken.

Disc diffusion method: Disc diffusion technique was done on Mueller-Hinton agar (MHA) plate A 48 hour culture of the test organisms grown on nutrient broth, opacity was compared with Mc Farland 0.5 standard (1.5×10^8 Colony forming Unit/ml) were swabbed over 3 different MH Agar plate. The undiluted extract of the *Curcuma longa*

was added to 25 sterile discs of 6mm diameter. The discs were then placed over the MHA with different strains of the organism and the zone of inhibition was measured in millimeters after incubation at 37°C for 48 hours. The disc diffusion technique was done in triplicate and the mean value of the zone of inhibition in millimeters was calculated. In addition a ampicillin disc was also used as a reference antimicrobial compound along with the test. The results were expressed in terms of the diameter of zone of the inhibition as: < 9 mm- resistant. 9-12 mm - partially active; 13-18 mm - active; >18mm - very active^[32].

Results and discussion

In the present investigation, ethanol extract of the *Curcuma longa* rhizome was evaluated for their antibacterial properties against wound pathogens. *Staphylococcus aureus*, *Escherichia coli* and *Pseudomonas aeruginosa*. These are the established pathogens in wound infections. 20 clinical strains of the test organisms were subjected to antibacterial action by undiluted alcoholic extract of *Curcuma longa*. In the study among the gram negative organism studied, out of the 20 strains 18 (90%) *Pseudomonas aeruginosa* strains were sensitive and 02 (10%) strain showed resistance against the extract. Out of 20 *Escherichia coli* strains tested 19 (95%) were sensitive and 01(05%) strain was resistant. In case of the Gram positive out of the 20strains tested 12 strains showed (60%)sensitive action but 08strains were resistant (40%). The sensitive organisms were again graded on the basis of zone of inhibition obtained. The antibacterial efficacy of the rhizome extract of *Curcuma longa* (L.) showed maximum efficacy against gram negative organism like *Escherichia coli* and *Pseudomonas aeruginosa* and was less effective against *Staphylococcus aureus*. It has been also reported that curcuminoids isolated from the rhizomes of *Curcuma longa* shows potent antimicrobial activity against *B. subtilis*, *E. coli*, *S. aureus* *Salmonella* and *Helicobacter pylori*^[26-29] whereas it showed moderate activity against *K. pneumonia*, *Enterobacter aerogenes* and *Pseudomonas aeruginosa*^[29]. The various

phytochemical study on the leaf and rhizome of the plant *Curcuma longa* revealed the presence of various active constituents such as alkaloids, tannins, flavonoids, glycosides and saponins seen in both the leaf and the rhizome extract [30]. It has been also reported that the alkaloids and flavonoids are the responsible compounds for antibacterial activity in various plants. It can also be said that the various components which are present both in the rhizomes and the leaf of the plant *Curcuma longa* is responsible for the antibacterial activity against pathogens. In the present study the alcoholic extracts were highly sensitive against the gramnegativeorganisms.

According to the various research it has been concluded that the rhizome show the presence of active constituents Curcuminoids showing various bands of Curcumin, bisdemethoxy curcumin and demethoxy curcumin in the isolation and characterization of curcuminoids by various techniques [30]. The active constituents present in the *Curcuma longa* leaf and rhizome leads to plasmolysis, cell disruption and death of the cell wall of the specific pathogen as seen in the evaluation of antimicrobial properties in *Curcuma longa* rhizome extract against *Staphylococcus aureus* strain by electron microscopy.

Table 1: Results of disc diffusion assay

Number of strains tested	Total number of sensitive isolates & percentage	Grading of sensitive isolates			Total number of resistant isolates & percentage
		Partially active	Active	Very active	
<i>Pseudomonas aeruginosa</i>	18 (90%)	00	01(6%)	17(94%)	02 (10%)
<i>Escherichia coli</i>	19 (95%)	00	02(11%)	17(89%)	01 (5%)
<i>Staphylococcus aureus</i>	12 (60%)	01(8.3%)	01(8.3%)	10(83%)	08 (40%)

Conclusion

This study shows that alcoholic extract of *Curcuma longa* rhizome has potent bactericidal effect on *Escherichia coli* and *Pseudomonas aeruginosa* and less effective against *Staphylococcus aureus*. This is a promising finding for developing an alternate treatment regimen for the control of wound infections caused by these organisms.

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