Original Article

A Curcumin-Nanosized Invasome Topical Formulation Evaluated Against Bacillus Subtilis Salmonella Bongori

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Abstract

Curcumin is a natural product that is applied to treat a broad range of human diseases, such as airway infections and inflammation. Curcumin, also known as diferuloylmethane, is an active component in the golden spice turmeric (Curcuma longa) and in *Curcuma xanthorrhiza oil*. It is a highly pleiotropic molecule that exhibits antibacterial, anti-inflammatory, hypoglycemic, antioxidant, wound-healing, and antimicrobial activities. Due to these properties, curcumin has been investigated for the treatment and supportive care of a variety of clinical conditions, including proteinuria, breast cancer, multiple myeloma, depression, and non-small cell lung cancer (NSCLC). Despite its proven efficacy against numerous experimental models, poor bioavailability due to poor absorption, rapid metabolism, and rapid systemic elimination have been shown to limit the therapeutic efficacy of curcumin. The current research is designed to explore the effect of a nanoscale invasome topical formulation of curcumin against Bacillus subtilis and Salmonella bongori. The antibacterial interest of the invasomal gel was assayed to determine a zone of inhibition towards distinct bacteria. The disc diffusion method was used to perform antimicrobial activities at three distinct awareness levels—25, 50, and 100 l/disc. indicated that the formula displayed a variable degree of antimicrobial activity in various strains. The inhibitory effect boomed with the increase in invasomal gel formula awareness from 50 to 100 l/disc. Bacillus subtilis was the most effective strain, with the strongest inhibition zone (8.6 0.754 to 14.7 0.374 mm), followed by Salmonella bongori (9.46 0.680 to 15.02 0.347 mm).

Keywords- Curcumin, Salmonella bongori, Bacillus subtilis, Invasomal gel, Antibacterial, Anti-inflammatory.

Introduction

Invasomes are novel vesicular systems that exhibit improved transdermal penetration compared to conventional liposomes. These vesicles contain phospholipids, ethanol, and terpene in their structures; these components confer suitable transdermal penetration properties to the soft vesicles. The main advantages of these nanovesicles lie in their ability to increase the permeability of the drug into the skin and decrease absorption into the systemic circulation, thus, limiting the activity of various drugs within the skin layer [1,2].

Turmeric is a spice that has received much interest from both the medical/scientific worlds as well as from the culinary world. Turmeric is a rhizomatous herbaceous perennial plant (Curcuma longa) of the ginger family. The medicinal properties of turmeric, the source of curcumin, have been known for thousands of years; however, the ability to

determine the exact mechanism(s) of action and to determine the bioactive components have only recently been investigated. Curcumin (1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione), also called diferuloylmethane, is the main natural polyphenol found in the rhizome of Curcuma longa (turmeric) and in others Curcuma spp. Curcuma longa has been traditionally used in Asian countries as a medical herb due to its antioxidant, anti-inflammatory, antimutagenic, antimicrobial and anticancer properties[3,4].

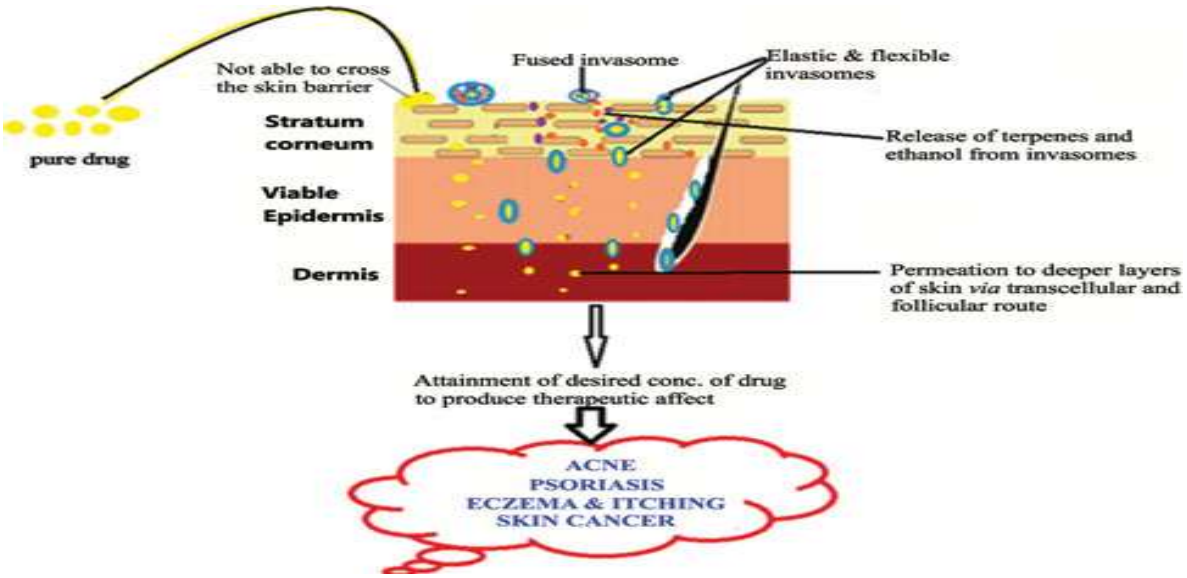

Figure-1Invasomes: Targeting different layers of skin

Material and Methods

The pathogenic bacteria used in the current study obtained from Microbial Culture collection, National Centre forcell science, Pune, Maharashtra, India.

Method of preparation

This agar medium was dissolved in distilled water and boiled in conical flask of sufficient capacity. Dry ingredients are transferred to flask containing required quantity of distilled water and heat to dissolve the medium completely[5,6]

Sterilization culture media

The flask containing medium was cotton plugged and was placed in autoclave for sterilization at 15 lbs /inch^2 (121^{o}C) for 15 minutes.

Preparation of plates

After sterilization, the media in flask was immediately poured (20 ml/ plate) into sterile petri dishes on plane surface. The poured plates were left at room temperature to solidify and incubate at 37^{o}C overnight to check the sterility of plates. The plates were dried at 50^{o}C for 30 minutes before use[7]

Revival of the microbial cultures

The microbial cultures used in the study were obtained in lyophilized form. With the help aseptic techniques, the lyophilized cultures are inoculated in sterile nutrient broth than incubated for 24 hours at 37^{o}C. After incubation the growth is observed in the form of turbidity. These broth cultures were further inoculated on to the nutrient agar plates

with loop full of microbes and further incubated for next 24 hours at 37ºC to obtain the pure culture and stored as stocks that are to be used in further research work[8].

Antibiogram Studies

The well diffusion method was used to determine the antibacterial activity of the Invasomal gel using standard procedure of Bauer et al, (1966).The drugused in standard preparation was ciprofloxacin of IP grade. The antibacterial activity wasperformed by using 24hr culture of Bacillus Subtilis, Staphylococcus aureusand Salmonella bongori. There were 3 concentrations used which are 25, 50 and100 mg/ml for Invasomal formulation in antibiogram studies. It's essential feature isthe placing of wells with the antibiotics on the surfaces of agar immediately after inoculationwith the organism tested. Undiluted overnight broth cultures should never be used as aninoculum. The plates were incubated at 370 C for 24 hr. and then examined for clear zones ofinhibition around the wells impregnated with particular concentration of drug. The diameterof zone of inhibition of each wall was recorded[9].

Results and Discussion of Anti-Microbial Activity

The antibacterial interest of the Invasomal gel turned into assayed to determine zone of inhibition towards distinct bacteria. That antimicrobial pastime of at three distinctive awareness 25, 50 and 100 µl/discs with the aid of disc diffusion method. Indicated that the formula displayed a variable diploma of antimicrobial activity of various strain. The inhibitory effect boom when increase of the invasomal gel formula awareness from 50 to 100 µl/discs.Bacillus subtilis was most effective strain with the strongest inhibition zone 8.6 ± 0.754 to 14.7 ± 0.374 mm) followed by Salmonella bongori(9.46 ± 0.680 to 15.02 ±0.347 mm).

Table 1:Antimicrobial activity of standard drug against selected microbes

S. No.	Name of drug	Microbes	Zone of inhibition		
			10 µg/ml	20 µg/ml	30 µg/ml
1	Streptomycin	Bacillus Subtilis	12 ±0.86	18±0.74	20±0.15
2		SalmonellaBongori	16±0.15	24±0.86	27±0.5

***(n=3, mean SD)**

Table 2:Antimicrobial activity of Invasomal formulation against selected microbes

S. No.	Name of microbes	Zone of inhibition		
		Hydroalcoholic extract of Invasomal Formulation		
		25mg/ml	50 mg/ml	100mg/ml
1.	Bacillus subtilis,	8.6 ± 0.754	10.1±0.673	14.7 ± 0.374
2.	SalmonellaBongori	9.46 ± 0.680	13.5 ± 0.905	15.02 ±0.347

***(n=3, mean ± SD)**

Figure-2 : Antimicrobial activity of Invasomal gel formulation

Conclusion

Curcumin is the most active component of turmeric that has been explored for its various biological and medicinal properties.In the present study, we focused upon the antibacterial activity of nanosized invasome topical formulation of curcumin against bacillus subtilis salmonella bongori including those that are Gram-positive (bacillus subtilis) and Gram-negative (salmonella bongori). The inhibitory effect boom when increase of the invasomal gel formula awareness from 50 to 100 µl/discs. Bacillus subtilis was most effective strain with the strongest inhibition zone 8.6 ± 0.754 to 14.7 ± 0.374 mm) followed by Salmonella bongori(9.46 ± 0.680 to 15.02 ±0.347 mm).

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Declarations

Conflict of Interest -The authors declare no potential conflicts of interest.

Ethical Approval -This Article does not contain any studies with human participants or animals performed by the author.

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