



TINOSPORA CORDIFOLIA: A NOVEL ANTIMICROBIAL AGENT

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ABSTRACT: Acne vulgaris is one of the most commonly encountered skin affliction that is prevalent in all teenagers and adults. It is a chronic inflammatory skin disorder of pilosebaceous unit which involves excess sebum production and modified lipid composition, skin duct blockage and colonization by *Propionibacterium acnes* bacteria which in turn, induces inflammation. Currently various therapeutic anti-acne drugs are available in market like, benzoyl peroxide, salicylic acid, retinoids and antibiotics to treat the microbial infection for moderate to severe cases. Within the light of the growing threat of antibiotic resistance and adverse effects of synthetic cosmeceuticals, natural plant products are considered as a safer alternative. *Tinospora cordifolia* is an important herb of tropical India in Ayurvedic system of medicines. Hence, we conducted an in vitro antimicrobial activity of aerial stem extract of *T. cordifolia* against *Propionibacterium acnes* using broth dilution method. The results obtained were compared against standard antibiotic tetracyclin. A preliminary phytochemical screening was also performed for qualitative determination of the phytoconstituents. The minimum inhibitory concentration (MIC) of stem extract of *Tinospora cordifolia* that inhibited the growth of *P. acnes* was found to be at 0.7 %. In the present study, the findings suggest that incorporation of stem extract of *Tinospora cordifolia* as an antimicrobial agent could be a potential treatment used for acne management.

Key words: - *Tinospora cordifolia*, antimicrobial, acne, anti acne, minimum inhibitory concentration

INTRODUCTION :

Acne vulgaris, the most common dermatological affliction predominantly affects adolescents and young adults [1, 2]. It is characterized by chronic inflammation of pilosebaceous units with several etiological factors such as androgen induced stimulation of sebaceous gland, epidermal hyperkeratinization, bacterial colonization. Its clinical manifestation includes seborrhoea, open and closed comedones, papules and pustules [3]. The *Propionibacterium acnes*, *Staphylococcus aureus* and *Staphylococcus epidermidis* are the major causative bacterial species for acne development [3, 4]. Currently, various synthetic topical agents includes retinoids, antibiotics, keratolytic agents, whereas systemic therapy covers isotretinoin, steroids and antibiotics [5]. However, widespread use of these synthetic drugs and antibiotics have numerous side effects and some have even developed bacterial

resistance upon its chronic use [2, 6]. To overcome these limitations, there is imperative need for development of herbal anti-acne drugs which are potent, safe, eco-friendly sustainable and having fewer side effects than synthetic ones.

Tinospora cordifolia commonly called as “Guduchi or Giloy” is a natural herbal shrub which belongs to the family of *Menispermaceae*. The phytochemical constituents of *T. cordifolia* include, alkaloids, glycosides, steroids, aliphatic compounds, essential oils, mixture of fatty acid, calcium, phosphorous, protein and polysaccharides [7, 8]. Berberine and furanolactone are the main constituents of the plant [7, 9]. *T. cordifolia* has wide spectrum therapeutic potential such as antidiabetic, anticancer, antioxidant, antimalarial, analgesic, anti-stress and anti-inflammatory [7]. Substantial studies also demonstrated

antimicrobial effects of *T. cordifolia* against multiple pathogenic bacteria [10, 11].

Studies on *T. cordifolia* revealed that it is an excellent drug and does not have any adverse or toxic effects till now [8]. Owing to its antimicrobial properties, it can be considered as an economical alternative for synthetic drugs. Hence, current study was undertaken to investigate the antimicrobial property of *T. cordifolia* that could serve as novel futuristic plant-based antibacterial agent for acne management.

MATERIALS AND METHODS:

Materials

An aerial stem of *Tinispora cordifolia* was procured from local suppliers and authenticated at Department of Botany, Rashtrasant Tukadoji Maharaj Nagpur University.

Soxhlet extraction of *T. cordifolia* aerial stem

The finely ground aerial stem of *T. cordifolia* (Figure. 1) was placed in the thimble chamber of Soxhlet apparatus and extracted with ethanol solvent. The ethanol in lower container was heated to boiling and its vapors condensed in the condenser. The temperature of the heating mantle was maintained at 80 °C. The extract obtained was concentrated by evaporation to obtain constant weight and yield.

Phytochemical screening

T. cordifolia stem extract was subjected to phytochemical screening for presence of bioactives such as alkaloids, carbohydrate, saponin, glycoside, protein, tannins and flavonoids [12, 13].

Antimicrobial activity Assay

Bacterial culture

In the present study, the standard bacterial culture of *Propionibacterium acne* MTCC-1951, was obtained from Microbial Type Culture Collection (MTCC), Chandigarh, India.

Broth dilution Method

The antibacterial activity of stem extract of *T. cordifolia* was measured using Broth or tube dilution method against *Propionibacterium acne* [14]. The positive control for *P. acne* was tetracycline (0.3 mg/ml).

Determination of minimum inhibitory concentration (MIC)

Minimum inhibitory concentration (MIC) is the lowest concentration of extract that inhibits the growth of test organisms by preventing the appearance of turbidity.

RESULTS AND DISCUSSION:

Phytochemicals are chemicals that are produced through primary or secondary metabolism by plants. The preliminary phytochemical screening assay showed the presence of carbohydrates, flavonoids, alkaloids, phenols, tannins proteins and aminoacids (Table 1.). These results are in accordance with previous findings suggesting the existence of different bioactive secondary metabolites which might be responsible for their medicinal attributes [15, 16].

In the present study, the antibacterial activity of the ethanolic stem extract of *T. cordifolia* against *Propionibacterium acne* was evaluated by broth dilution assay [14]. The broth dilution assay displayed a dose-dependent inhibition of bacterial growth with increasing concentrations of the stem extract of *T. cordifolia* (Table 2.). The lowest concentration (MIC) of stem extract of *T. cordifolia* that inhibited the growth of *P. acne* was found to be at 0.7 mg/ml as compared to control group (Figure 2.). Our results collaborate previous findings [10, 11]. The antimicrobial effect of *T. cordifolia* has been attributed to its major constituent, berberine [17]. Many studies have shown that berberine can increase the inhibitory effects of antibiotics against bacteria that are clinically multi-drug resistant [9]. Taken together, in the present study, we speculate that *T. cordifolia* induced antimicrobial action at 0.7% might be an outcome of major active constituent, berberine. Further study might be

needed to unveil the isolation and characterization of berberine in mediating its antimicrobial effects.

CONCLUSION:

The stem extract of *T. cordifolia* has shown antibacterial potential against major acne causing bacteria *P.acne*. We suggest that incorporation of stem extract of *T. cordifolia* as an anti-acne agent might be a novel herbal approach to mitigate side effects and bacterial resistance associated with current synthetic drugs.

CONFLICT OF INTEREST:

The authors declare that they have no conflict of interest.

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Table No. 1. Result of phytochemical screening assay

Secondary Metabolites	Name of the Tests	<i>T. Cordifolia</i> (Ethanollic extract)
Flavonoids	Alkaline reagent Test	+ + +
Alkaloids	Mayer's Test	+ + +
	Dragendorff's Test	
Carbohydrate	Molish's Test	+ +
	Benedict's Test	
Glycosides	Keller Killiani Test	+
Saponins	Foam Test	-
Proteins and Amino Acids	Biuret Test	+
Phenols and Tannins	Ferric Chloride Test	+ +

Table No. 2. Evaluation of minimum inhibitory concentration (MIC) against *Propionibacterium acnes* using broth dilution method.

Sr. No.	Amount of extract (mg/ml)	Amount of Medium (ml)	Total volume of solution (ml)	Concentration of extract in final solution (mg/ml)	Turbidity
1	0.4	9.6	10	0.04	+++
2	0.5	9.5	10	0.05	+++
3	0.6	9.4	10	0.06	+
4	0.7	9.3	10	0.07	-
5	-	10	10	0	-



Figure No. 1: The aerial stem of *Tinispora cordifolia* (Authenticated)

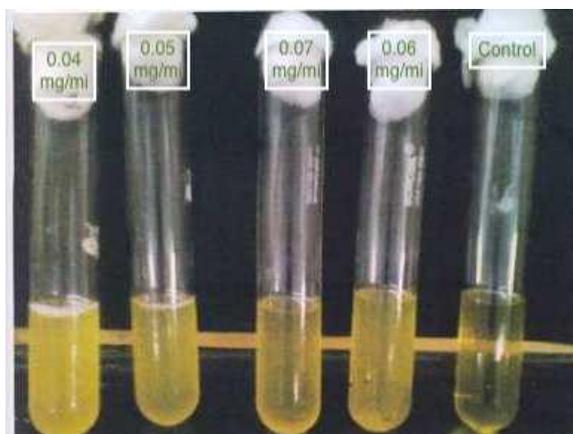


Figure. 2: Antimicrobial assay of *T. cordifolia* stem extract by broth dilution method