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Indian medicinal herbs' antimicrobial properties against germs that cause acne

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Abstract

It has been shown that Propionibacterium acnes and Staphylococcus epidermidis are the pus-forming bacteria that cause acne inflammation. The goal of the current research was to assess the antibacterial properties of Indian medicinal herbs against various acne vulgaris causal factors. Disc diffusion and broth dilution methods were used to test the antimicrobial activities of ethanolic extracts of Hemidesmus indicus (roots), Eclipta alba (fruits), Coscinium fenestratum (stems), Curcubito pepo (seeds), Tephrosia purpurea (roots), Mentha piperita (leaves), Pongamia pinnata (seeds), Symplocos racemosa (barks), Euphorbia hirta (roots), Tinospora cordyfolia (roots), Thespesia populnea (roots), and Jasminum officinale (flowers). According to the disc diffusion technique findings, seven medicinal herbs have the ability to stop Propionibacterium acnes from growing. Strong inhibitory effects were seen in Hemidesmus indicus, Coscinium fenestratum, Tephrosia purpurea, Euphorbia hirta, Symplocos racemosa, Curcubito pepo, and Eclipta alba. The extract from Coscinium fenestratum had the strongest antibacterial activity when tested using a broth dilution technique. The MBC values against Propionibacterium acnes and Staphylococcus epidermidis were 0.165 and 0.049 mg/ml, respectively, whereas the MIC values for both bacterial species were the same at 0.049 mg/ml.

INTRODUCTION

The most prevalent skin condition in the pilosebaceous unit is acne vulgaris. This affects the face, back, and trunk, which are the regions with the biggest oil glands1. Seborrhea, comedones, inflammatory lesions, Propionibacterium acnes, Staphylococcus epidermidis, and Malassezia furfur in the follicular canal, as well as sebum production 2, are the common characteristics. It has been stated that Propionibacterium acnes is an obligatory anaerobic bacteria. Its capacity to activate complements and convert sebaceous triglycerides into fatty acids, which neutrophils are drawn to, has been linked to the development of inflammatory acne. Conversely, the anaerobic bacteria Staphylococcus epidermidis often causes superficial infections in the sebaceous unit3. These elements provide a possible therapeutic target.

Antiacne medications target Propionibacterium acnes and Staphylococcus epidermidis4, 5. Due to increased antibiotic resistance, long-term usage of antibiotics to treat acne is no longer recommended.6, Antibiotic resistance arises from a complex interplay between several elements, such as the kind of bacteria-antibiotic association, the way antibiotics are administered, host features, and environmental conditions. Many studies have been conducted on medicinal plants as potential alternative therapies for illnesses in an effort to address the issue of antibiotic resistance. Twelve medicinal plants that have historically been employed as antimicrobial and anti-inflammatory agents were tested in this research for their ability to inhibit Propionibacterium acnes and Staphylococcus epidermidis, two common bacteria that cause acne inflammation.

MATERIALS AND METHODS

Plant material

The twelve plant specimens included in this investigation were gathered from different parts of India. By comparing the plant materials with specimens found in Bangalore, the authenticity of the items was confirmed. Regional Research Institute (Ayurveda), Jaynagar, Bangalore; Herbarium and Botanical Section. The samples were given to the Rural College of Pharmacy's Department of Pharmacognosy at Devanahalli, Bangalore Rural District, Karnataka, India.

Microbes in addition to media

Propionibacterium acnes (MTCC 1951) and Staphylococcus epidermidis (MTCC 931) were the test organisms employed in this investigation. The Microbial Type Culture Collection and Gene Bank in Chandigarh, India is the source of these microorganisms. Every media item was bought from Himedia.

Making Plant Extract Preparations

Coarse powder was created from dried plant pieces. 400 g of the following were macerated in ethanol: Euphorbia hirta (roots, 17.4% w/w), Tinospora cordyfolia (roots, 18.4% w/w), Thespesia populnea (roots, 17.6% w/w), Curcubito pepo (seeds, 17.9% w/w), Tephrosia purpurea (roots, 6.9% w/w), Mentha piperita (leaves, 14.3% w/w), Symplocos racemosa (barks, 19.5% w/w), Euphorbia hirta (roots, 17.4% w/w), Eclipta alba (fruits, 13.1% w/w), Coscinium fenestratum (stems, 20.4% w/w), and Jasminum officinale (flowers, 12.5% w/w). After seven days in a row, the macerate was filtered, and the filtrate was then dried under low pressure and vacuum desiccator.

Testing for antibiotic susceptibility

Disc diffusion technique

With a few adjustments, the Hayes and Markovic8 approach was used to conduct this experiment. After 48 hours of anaerobic incubation in brain heart infusion medium (BHI) containing 1% glucose, Propionibacterium acnes was modified to produce around 1.0×108 CFU/ml. As the agar basis, aliquots of melted BHI combined with glucose agar were used. The melted agar was combined with a prepared inoculum, then poured over the agar foundation and allowed to solidify. The test substance (100 mg/ml) was impregnated onto a sterile paper disc, which was then put on the agar. As the benchmark, 10 µg/ml of clindamycin was used. The plates were then placed in an anaerobic 48-hour incubator at 370C. TABLE 1: Medicinal Plant Extracts' Antimicrobial Activity

Plant extracts	Susceptibility of bacteria to medicinal plant extracts Zone of inhibition (mm)[A,*]	
	Propionibacterium acnes	*Staphylococcus epidermidis*
Hemidesmus indicus	13	14
Eclipta alba	12	10
Coscinium fenestratum	15	16
Curcubito pepo	12	14
Tephrosia purpurea	12	13
Mentha piperita	06	12
Pongamia pinnata	06	09
Symplocos racemosa	14	14
Euphorbia hirta	13	12
Tinospora cordyfolia	07	06
Thespesia populnea	05	05
Jasminum officinale	06	07
Clindamycin	19	20

[A]Concentration of the extract used: 100 mg / ml, Clindamycin: 100 µg / ml
*Mean of triplicate measurements

circumstances in a gas pack and indicator strip-equipped anaerobic jar (Hi-Media), which was then incubated for 48 hours at 37 ± 10C. The anaerobiosis was maintained and monitored using gas packs containing sodium carbonate, citric acid, and sodium borohydride. When these substances come into contact with oxygen, sodium borohydride releases hydrogen and citric acid produces carbon dioxide. When added to the jar, an indicator strip of methylene blue becomes blue instead of white when anaerobiosis is not present. Tryptic soy broth (TSB) was used to incubate Staphylococcus epidermidis for a full day at 370C. The culture was modified to produce around 1.0×108 CFU/ml. The steps were the same as previously described, with the exception that the plates were incubated aerobically for 24 hours at 370C. The antibacterial activity of each disc diffusion test was determined by calculating the mean of the inhibition diameters (mm) across three independent trials (refer to Table 1).

RESULTS

Twelve extracts from medicinal plants were tested in this research for their ability to inhibit Propionibacterium acnes and Staphylococcus epidermidis. The results demonstrated that 07 extracts have the ability to successfully stop Propionibacterium acnes from growing. Hemidesmus indicus, Epifta alba, Coscinium fenestratum, Curcubito pepo, Symplocos racemosa, Euphorbia hirta, and Tephrosia purpurea were among those whose ethanolic extracts exhibited potent inhibitory effects. Table 1 Antibacterial properties of extracts from Coscinium fenestratum, Hemidesmus indicus, and Symplocos racemosa were observed to be promising against Propionibacterium acnes and Staphylococcus epidermidis. The five plant extracts that remained had The MIC and MBC values of twelve medicinal plant extracts against Staphylococcus epidermidis and Propionibacterium acnes are shown in Table 2. The average of the three measurements is shown for the findings.

Plant extracts	Susceptibility of bacteria to medicinal plant extracts[a]			
	Propionibacterium acnes		*Staphylococcus epidermidis*	
	MIC (mg/ml)	MBC (mg/ml)	MIC (mg/ml)	MBC (mg/ml)
Hemidesmus indicus	0.051	2.5	1.25	>4
Eclipta alba	0.665	>5	0.312	>5
Coscinium fenestratum	0.049	0.049	0.049	0.165
Curcubito pepo	1.25	1.25	2.5	5
Tephrosia purpurea	0.675	1.25	2.5	>5
Mentha piperita	>5	>5	>5	>5
Pongamia pinnata	2.5	>5	2.5	>5
Symplocos racemosa	0.685	1.35	0.685	>4
Euphorbia hirta	1.55	1.95	2.5	5
Tinospora cordyfolia	5	5	5	>5
Thespesia populnea	>5	>5	>5	>5
Jasminum officinale	5	>5	>5	>5
Clindamycin*	78	85	76	72

[a]The results indicate of average of 3 separate experiments
*Clindamycin- All values are in µg/ml

not a trace of Staphylococcus epidermidis activity. All of the chosen plant extracts' inhibitory concentrations were found via further testing. Coscinium fenestratum shown the strong antibacterial activity. Propionibacterium acnes and Staphylococcus epidermidis had MBC values of 0.165 and 0.049 mg/ml, respectively, whereas the MIC values were the same (0.049 mg/ml) (Table 2). Additionally, a preliminary phytochemical screening was performed on the plant extracts to determine whether or not certain chemical groups were present (Table 3).

DISCUSSION

The ethanolic extract of Coscinium fenestratum may have bactericidal properties against Propionibacterium acnes, based on the same values of MIC and MBC that were obtained from this plant against this microbe. Furthermore, the Hemidesmus indicus extract demonstrated strong antimicrobial activity against Propionibacterium acnes, with a minimum inhibitory concentration (MIC) of 0.051 mg/ml. However, a higher concentration was necessary to eradicate Propionibacterium acnes and Staphylococcus epidermidis in comparison to the Coscinium fenestratum ethanolic extract. Using the disc diffusion test, Symplocos racemosa demonstrated exceptional antibacterial activity against Propionibacterium acnes, with an MBC of 1.35 mg/ml and a MIC value of 0.685 mg/ml for each species. Phytochemical screening was used to further evaluate the plant extracts in order to find phytoconstituents. Strong inhibition zones of Coscinium fenestratum extract against Propionibacterium acnes growth were shown in the bioautography test. The fact that the clear zones were spread out over the TLC plate indicates that many compounds may have had antibacterial properties. Above the bands of the other plant extracts coated with Propionibacterium acnes, there were no inhibitory zones visible. This suggested that Propionibacterium acnes was the target of the Coscinium fenestratum extract's greatest action. Coscinium fenestratum extract tested positively for alkaloids by phytochemical screening. Methicillin-resistant S. aureus and Staphylococcus aureus are targets of alkaloids and their derivatives13. The capacity of highly aromatic planar quaternary alkaloids to intercalate with DNA15 is thought to represent the mechanism of action of substances like harmane14 and berberine. Berberine, an alkaloid found in Coscinium fenestratum, may inhibit Propionibacterium acnes and Staphylococcus epidermidis by a similar mechanism. As a result, additional research into the active ingredient in the Coscinium fenestratum extract as a potential acne treatment option may be worthwhile.

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