Formulation and Evaluation of Antibacterial and Anti-Inflammatory Cream Containing *Sesbania grandiflora* Leaves Extract

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Abstract: **Ultraviolet light and gamma rays directly fall on skin from the sun which causes many serious side effects like skin cancer, aging of skin, acne, etc. Skin related bacterial infection is depended on type of skin condition, atmospheric condition and hygienic condition. The purpose of our study is to overcome the above problem related to skin. The extraction of leaves of *Sesbania grandiflora* was done by Soxhlet apparatus extraction process by using ethanol as a solvent. For drying purposes freeze dryer was used. The phytochemical screening of leaves extract of *Sesbania grandiflora* was done and it showed that it consists of terpenoids, flavonoid, alkaloids. The antioxidant activity & antibacterial activity of both extracts were evaluated, it shows the significance results which were compared with standard ascorbic acid and gentamicin respectively. The formulation of cream leaves extract respectively showed good effects as antibacterial and antiaging property.**

Keywords: ***Sesbania grandiflora,*** **Antioxidant, Antibacterial, Cream.**

INTRODUCTION

Sesbania grandiflora (L.) Poir. commonly known as august (H), agati (S), rain tree (E) belongs to family Caesalpiniaceae is a medium size tree, with green, glabrous, twining branches having leaves, flowers white, reddish or pale creams. The other scientific names of sesbania are *Robinia grandiflora Linn, Aeshynomene grandiflora Linn, Sesban grandiflora Poir, Agati grandiflora (L.) Desv.* A small erect quick growing short-lived soft-wooded tree sparsely branched. *Sesbania* grandiflora is commonly known as agati/Avisa. All parts of *Sesbania grandiflora* plant have medicinal value. It has various nutritional value thus; it is used in food also. The active ingredients of sesbania are leucocyanidin and cyanidin present in seeds, oleanolic acid and its methyl ester and kaemferol-3-rutinoside which are present in flower. The bark contains tannins and gum. Saponin isolated from the seeds. Sesbanimide isolated from seeds[1].

All parts of *Sesbania grandiflora* are utilized for medicine in Southeastern Asia and India including preparations derived from the roots, bark, gum, leaves, flowers, and fruit. In Folk Medicine it is claimed to be aperient, diuretic, emetic, emmenagogue, febrifuge, laxative, and tonic. Agati is a folk treatment for bruises, catarrh, dysentery, eyes, fevers, headaches, smallpox, sores, sore throat and stomatitis[2]. Anemia, bronchitis, fever, headache, ophthalmia, nasal catarrh, inflammation, leprosy, gout, and rheumatism are among the many conditions that can be treated with various portions of this plant in the Siddha school of Indian traditional medicine.

Additionally, it has hepatoprotective, anticancer, antibacterial, analgesic, antipyretic, anxiolytic, antiulcer, and antioxidant qualities.[3]

The term "antibacterial activity" describes compounds (drugs) that kill or inhibit the growth of bacteria. Numerous antibiotics have been developed to treat different kinds of illnesses.

Microorganisms are still becoming resistant to the current antibiotics, though. Infectious diseases continue to rank as the second most common cause of death worldwide due to the problem of antibiotic resistance.

In the past few years, antibacterial agents derived from plant metabolites have gradually grown attention. The growth in infectious diseases and the advent of microorganisms resistant to drugs could be the cause of this. The use of plant secondary metabolites as resistance-modifying agents is an alternate strategy for dealing with such issues.[4]

Topical drug administration is a localized drug delivery system anywhere in the body through ophthalmic, rectal, vaginal and skin as topical routes. The skin serves as the primary channel for topical drug delivery systems and is one of the most accessible organs in the human body. Numerous medications are administered to the skin or mucous membranes that either pharmacologically change an activity in the highlighted tissues or improve or restore a basic skin function[5]. Cream is the semi-solid biphasic dosage form; cold creams are W/O type of emulsion. Effective topical therapies are urgently needed due to the rise in antibiotic-resistant types of bacteria and the rising incidence of bacterial illnesses.There are reports stated that the plant extracts used for cosmetic and personal care applications. Hence, the aim of this study is to formulate and evaluate the antibacterial and antioxidant activity of the cream containing *Sesbania grandiflora* leaves extract[6].

MATERIAL AND METHODS

MATERIAL

COLLECTION OF PLANT MATERIAL

Sesbania grandiflora (family Fabaceae) were collected from local areas of Arbali, Maharashtra, India. The foreign, earthy matter and residual materials were removed carefully from the leaves and then cleaned and dried in the shade. It was then powdered and used for extraction.

EXTRACTION OF PLANT MATERIAL

Extraction of leaves: About 100g dried leaves powder was subjected to Soxhlet apparatus. Then 500ml of ethanol was added to the round bottom flask the solution was heated at 50°C for 6-7 hr to complete 5 cycles. The collected extract was then dried using Freeze dryer. To determine the various phytoconstituents, the prepared extract was subjected to various chemical tests according to standard procedure[7].

PHYTOCHEMICAL SCREENING[8]

1) Leaves extract

Alkaloid Test

a) Wagner's Test

Few mL filtrate + 1-2 drops of Wagner's reagent (Along the sides of test tube) which gives brown/reddish precipitate.

b) Hager's test

Few mL filtrate + 1-2 mL Hager's reagents which gives creamy white precipitate.

Flavonoids Test

a) Ferric chloride test

Extract aqueous solution + few drops 10% ferric chloride solution which gives green precipitate.

Terpenoids Test

2ml chloroform + 5mL plant extract, (evaporated on water bath) + 3mL conc. H_2SO_4 (boiled on water bath) A grey coloured solution.

FORMULATION OF CREAM

Aqueous Phase: *Sesbania grandiflora* leaves extract, Distilled Water, Propyl paraben, Perfume.

Oil Phase: Liquid paraffin, Glycerin, Bees Wax.

Weigh accurate quantity of all the ingredient as shown in table 1.

Heat A & B phase separately in China dish at about 75℃. Add aqueous phase in oil phase slowly with continuous stirring until thick stable emulsion formed. Add perfume when temperature has fallen to 35℃. & stir again[9].

Table 1: Formulation table for Face Cream

Sr. No.	Ingredients	Quantity	Role of Ingredients
1.	Bees wax	6.0gm	Cream base
2.	Liquid paraffin	2.9gm	Soothing agent
3.	Glycerin	3.2gm	Moisturizer
4.	S.G. leaves extract	0.5gm	Antibacterial
5.	Water	17gm	Vehicle
6.	Perfume	q.s.	Fragrance
7.	Propyl paraben	0.015gm	Preservative

EVALUATION PARAMETERS FOR CREAM

Physical Evaluation

This test assessed the cream's physical qualities, including color, thickness, roughness, and odor, as well as its organoleptic qualities, such as color and appearance.

Irritation Test

On the dorsal surface of the left hand, mark a 1 sq. cm area. The time was recorded and the cream was applied to the designated area. Edema, erythema, and irritation were monitored for up to 24 hours at regular intervals.

Washability

The washability of cream is determined by applying the small amount of cream on hand washing it with water, and checking it manually

pH

0.5 g cream was taken and dispersed in 50 ml distilled water and then PH was measured by using digital PH meter[10].

Spreadability

The spreadability was expressed in terms of time in seconds taken by two slides to slip off from the cream, placed in between the slides, under certain load. Lesser the time taken for separation of the two slides better the spreadability. Two sets of glass slides of standard dimension were taken. Then one slide of suitable dimension was taken and the cream formulation was placed on that slide. Then other slide was placed on the top of the formulation. Then a weight or certain load was placed on the upper slide so that the cream between the two slides was pressed uniformly to form a thin layer. Then the weight was removed and excess of formulation adhering to the slides was scrapped off. The upper slide was allowed to slip off freely by the force of weight of weight tied to it. The time taken by the upper slide to slip off was noted.

Spreadability= m × l/t

Where,

m= Standard weight which is tied to or placed over the upper slide (30g)

l= length of a glass slide (5 cm)

t= time taken in seconds.

Viscosity

The viscosity of the formulated cream was analyzed by using Brookfield Viscometer. The Brookfield viscometer works by rotating a cylindrical spindle of moon surface area in the cream.. Holding the viscometer side with extreme caution, insert the spindle by screwing it counterclockwise. Using the mounting nut on the viscometer handle, carefully lower the viscometer into the cream to be measured. Place it up to the spindle's insertion marker. Verify that the viscometer remains level. Activate the viscometer and adjust the speed to your preference. Press down on the clutch lever to mark the torque after a few rotations for the reading to stabilize. Once the needle is in front of the view window, turn off the motor and check the scale. After use, clean up and unplug the viscometer[11].

Cyclical Temperature Test

This test is not carried out at any fixed temperature and humidity. In this test, temperature was changed cyclically every day. At room temperature and frizzing temperature to stimulates the changes in temperature[12].

Determination of antibacterial activities by agar diffusion

The bacterial inhibitory effect of *S. grandiflora* extracts was carried out by standard agar well diffusion method. The NS suspension of several bacteria was used to seed the TSA plate. A sterile cork borer was used to cut out a well with a diameter of 6 mm in each plate. 50 µL of the appropriate diluted extract was cautiously applied to each well using a sterile autopipette.

The same volume of 50% ethanol was used as a negative control. At 37°C, the plates were incubated throughout the entire night. The diameter of the inhibition zone (DIZ) was measured in order to assess the antibacterial activity. Three duplicates of the experiment were conducted, and the inhibition zone's mean diameter was computed[13].

Determination Antioxidant activity

The free-radical scavenging effect of *S. grandiflora* was measured with the stable radical scavenger diphenylpicrylhydrazyl (DPPH) with minor modification. Briefly, the concentrations (20–1000µg/ml) of EQSG and AQSG were prepared in respective solvent. Positive control ascorbic acid was prepared with different concentration (1-100 µg/ml). Separately, 1 ml of extract and standard solution were combined with 1 ml of DPPH solution (0.1 mM in methanol) and left in the dark for 30 minutes. At a particular wavelength, the absorbance was measured.

The intensity of discoloration of DPPH-purple to DPPH-yellow indicated the scavenging efficiency of the extract. Lower absorbance indicated higher free radical-scavenging activity. IC50, or the concentration (µg/ml) of extract that suppresses the production of DPPH radicals by 50%, was used to express the extract's antioxidant activity. Every test was run in triplicate.

The percentage scavenging activity was determined by formula:

% Scavenging = [(A-B)/A] *100

Where,

A was the absorbance of control (DPPH solution without the sample),

B was the absorbance of DPPH solution in the presence of the sample (extract/ascorbic acid)[14].

RESULT & DISCUSSION

Table 2: Phytochemical Screening of leaves extract

Sr. No.	Phytochemical Screening of leaves extract	Result & Discussion
1.	Alkaloid Test i. Wagner's Test ii. Heger's Test	 Positive Positive
2.	Flavonoids Test	Positive
3.	Terpenoids Test	Positive

Table 3: Evaluation Parameter of cream

Sr. No.	Evaluation Parameter of cream	Result & Discussion
1.	Organoleptic Parameter i. Color ii. Odor ii. Appearance v. Stability	 Light Green Pleasant Smooth & Shiny Stable at Different Temperature.
2.	pH	6.97
3.	Spreadability	5.6 cm
4.	Viscosity	161.9 cps
5.	Water Washability	Easily removed after washing hand with warm water
6.	Stability Test i. Visual Appearance ii. Phase separation ii. Homogeneity	 No Change Nil Good
7.	Irritancy Test	No irritancy

Table 4: Antibacterial Test Result of leave extract

Sr. No.	Name of the Microorganism	Diameter of zone of inhibition (mm)		
		DSMO (Control)	Gentamicin 10 mg (Standard)	Test Sample (Leaves Extract)
1	*Escherichia coli*	20	20	15
2	*Pseudomonas aeruginosa*	15	20	17
3	*Staphylococcus aureus*	17	22	15
4	*Bacillus subtilis*	15	25	15

Tabel 5: Anti-oxidant Test of Leaves Extract

Sr.no.	Concentration(µg/ml)	Absorbance of ascorbic acid (Standard)	Absorbance of Leaves	Absorbance of flower
1	100	1.274	0.697	0.889
2	200	1.627	0.763	0.968
3	300	1.929	0.828	0.996
4	400	1.993	0.837	1.591
5	500	2.181	0.893	1.828

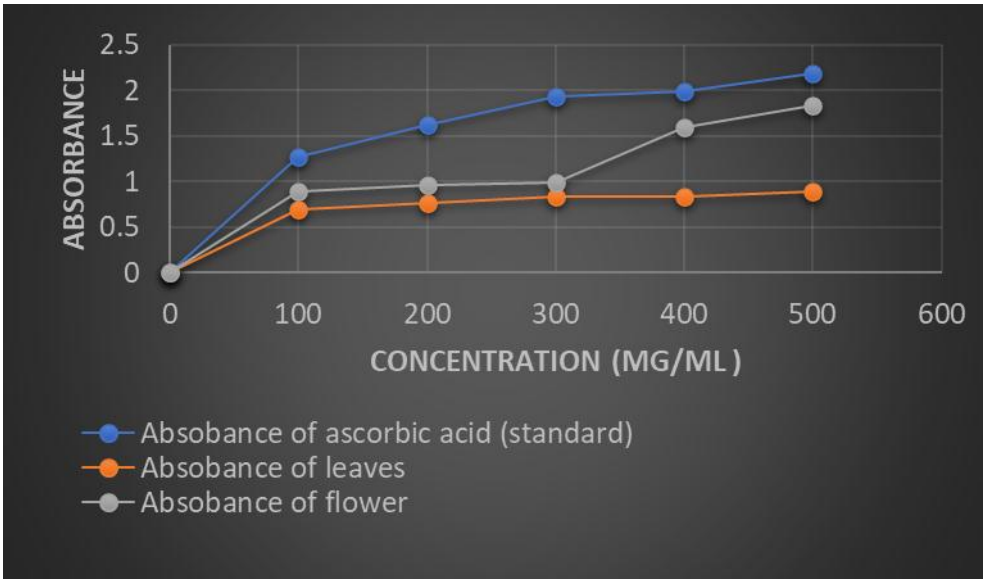

Fig 1: In vitro antioxidant properties of *S. grandiflora* Leaves

CONCLUSION

Leave extracts with antibacterial activity have been formulated as topical creams. The antibacterial and anti-inflammatory activity of the extract of *Sesbania grandiflora* was evaluated. This activity was preserved when the extract was incorporated into the formulated cream. Thus, conclusion can be made that the serum containing S. grandiflora flower extract have been able to cure bacterial infections and inflammations of facial skin. The cream was intended to be used for the antibacterial and anti-oxidant purpose. In order to treat a range of skin disorders, the study found that the herbal serum formulation made using Sesbania grandiflora extract was non-irritating, washable, and had good pH, spreadability, and viscosity results.

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