



A REVIEW OF ANTIMICROBIAL ACTIVITY PRESENT IN MUCOADHESIVE DENTAL GEL OF AERIAL PARTS OF FICUS RACEMOSA L TO ENHANCE THE THERAPEUTICAL ACTIVITY BY USING CLOVE OIL

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ABSTRACT

The main purpose of the review is to develop and evaluate a muco-adhesive dental gel containing a herbal medicine for the management of toothache. The ethanolic extract of the aerial parts of *Ficus racemosa* Linn screening. Antimicrobial activity of the extract was done to against the streptococcus mutans by using well diffusion method. The gel was prepared using carbopol 940, sodium carboxy methyl cellulose, propylene glycol, hydroxy methyl cellulose and clove oil as a permeation enhancer. *Ficus racemosa* aerial part extract was to be prepared by ethanol and water ratio of (80:20v/v). five gel formulations were prepared at two different grades and various concentration of Carbopol. The gel formulation evaluated for different organoleptic properties were pH, viscosity, Spreadability and phytochemical constitution screening technique. The optimized studies were diffusion study, stability testing, drug content to determination the release of drug contain percent

cumulative study from gel formulation and present activity studies Mucoadhesive gel strength was measured and in- vitro studies of anti-microbial activity and drug realease. From the antimicrobial study, it was observed the optimized formulation and marketed formulation produced almost equal zone of inhibition. The evaluation parameters of optimized batch

indicate that the prepared mucoadhesive dental gel is stable, good drug delivery system contains antimicrobial agents for the prevention of periodontitis, tooth pain and dental caries. Based on a in-vitro evaluation of mucoadhesive studies, it was selected as the best formulation.

KEYWORDS: Ficus racemosa, Aerial parts, Clove oil, Mucoadhesive dental gel, Phytochemicals, Carbopol, Sodium CMC, HPMC.

INTRODUCTION

The combining of **Ficus racemosa** extracts with **clove oil** in a mucoadhesive dental gel significantly enhances the antimicrobial and therapeutic efficacy for oral conditions like periodontitis and toothache. Ficus racemosa is an important traditional medicinal plant, the present study was carried out to explore the phytochemical and antimicrobial properties of this plant against clinical pathogens. The ethanol extract of Ficus racemosa to exhibited the many phytochemical compounds of 10 μ g/mL of the extract in manifested good antimicrobial activity. To overcome and the combact to increasing the multidrug to resistance strains, there is an urgent need to they develop antimicrobial agents against the multidrug-resistant strains. Ficus racemosa (Moraceae) is an evergreen, moderate to large sized spreading, lactiferous, deciduous tree, without much prominent aerial roots found throughout greater part of India in moist localities and is often the cultivated in villages for edible fruit. The tree is medium tall, growing to 10-17 meters in height. The rich green foliage provides a good shade. The leaves are dark green and 7-10 cm long, ovate or elliptic shape.

The fruit receptacles 2-4.5 cm in diameter, pyriform, in large clusters, arising from main trunk of branches. Ficus racemosa documented to possess anti-inflammatory, anti-pyretic, antidiuretic. The bark and leaves of this group was used to anti-microbial, astringent, haemostatic, antiseptic, anti-inflammatory, diabetic prescribed in diarrhea, dysentery and the treatment of skin disease and ulcers and vaginal disorder of leucorrhoea monorrhagia deficient lactation and act as urinary astringent. The powered leaves of Ficus racemosa when mixed with honey is given in bilious infections. The plant (roots, bark-skin, fruits and the leaves) possesses great medicinal value, the present study was carried out to explore the phytochemical constituents and antimicrobial effect of Ficus racemosa leaves against bacterial pathogens and microbial action.

MATERIAL AND METHODS

Collection of plant materials

The fresh leaves of plant *Ficus racemosa* was collected from near of Namakkal in Tamil Nadu. The leaves were properly washed, shade dried completely for 3-4 days and was finely ground to powder by using mixer grinder.

Chemicals

Carbopol 940, sodium carboxy methyl cellulose, propylene glycol, hydroxy methyl cellulose and clove oil, sodium carbonate anhydrous methyl paraben, propyl paraben, ethanol and triethanolamine.

Preparation of extracts

Finely ground powder of leaves (50 g) of *Ficus racemosa* was extracted using ethanol separation by using soxhlet extractor by not exceeding the boiling point of the solvent. The obtained extract were filtered by through the Whatman Filter Paper No.1. Then the concentrated under reduced the atmospheric pressure. The dry extracts were stored at -20°C.

Preparation of gel formulation

Three gel are formulations were prepared by with different concentrations of carbopol. Initially, methyl-paraben and propyl-paraben solution were prepared in water and the carbopol 934 was soaked in to the water for 24 h followed by neutralization with triethanolamine chemical to pH 6.8 for preparation of gel. Solutions of the measured quantity of the extracts of both drugs were prepared in 10 ml of ethanol and added to the gel and they required to the quantity of polyethylene glycol (PEG 400) was added. Composition of the mucoadhesive gel was shown in table no 1.

Table 1: Preparation of gel at variable concentration of carbopol 940.

S.no	Ingredients	F-1	F-2	F-3	F-4	F-5
1	Ethanol extract of aerial root	2.5 g	2.5 g	2.5 g	2.5 g	2.5 g
2	Carbopol 940	0.2g	0.4g	0.6g	0.8g	1.0g
3	PEG	5ml	5ml	5ml	5ml	5ml
4	Propyl paraben	0.02 g	0.02 g	0.02 g	0.02 g	0.02 g
5	Methyl paraben	0.2g	0.2g	0.2g	0.2g	0.2g
6	Triethanolamine	q. s	q. s	q. s	q. s	q. s
7	Clove oil	0.3ml	0.3ml	0.3ml	0.3ml	0.3ml
8	Distilled water	q. s	q. s	q. s	q. s	q. s

Preparation of gel formulations

For preparation of mucoadhesive gel formulations, of semisolid concentrated extracts of the *Ficus racemosa* were used. Sodium CMC, Carbopol 940 and HPMC polymers were used as the gelling agent.

Phytochemical analysis

The ethanol extracts from *Ficus racemosa* were studied for their phytochemical constituents of test for carbohydrates, steroids, proteins, phenols, flavanoids, quinones, tannins, saponins and alkaloids.

Test for carbohydrate detection

The ethanol extracts of *Ficus racemosa* were tested with Molisch reagent, Fehling reagent, Benedict's solution and Barfeod's test for detection of carbohydrates. A small quantity of ethanol extracts were separately dissolved in 5 mL of distilled water and filtered. The filtrate obtained from these extracts were maintained and they used for phytochemical analysis.

Test for Steroids

0.3 mL of extracts was treated with 3 mL of chloroform and 3 mL of concentrated sulphuric acid. The appearance of red color in upper layer and yellow color with green fluorescence to indicates the presence of steroids.

Test for Alkaloids

A small quantity of solvent extracts were separately from mixed with 4 mL of hydrochloric acid and filtered, the filtrate was tested with Mayer's reagent, Dragendroff's reagent to confirm the presence or absence of alkaloids.

Test for Saponins

The small quantity of the extracts was diluted with 10 mL of distilled water and it was agitated for 15 min. Formation of 1cm layer of the foam was shows the presence of saponins components.

Test for Quinones

0.5 mL of filtered extracts was treated with 0.5 mL of concentrated sulphuric acid. The formation of red color to shows the presence of quinones.

Test for Tannins

The filtered extracts was treated with 2 mL of 5% FeCl₃, bluish-black precipitates formation indicates the presence of tannins in the solvent extract.

Test for Phenols

0.5 mL of the filtered extracts was treated with 10% of ferric chloride solution. The appearance of green color indicates presence of phenols.

Test for Flavanoids

A small quantity of extracts was dissolved in alcohol, few pieces of magnesium was added to it followed by drop wise addition of concentrated HCl. The appearance of magenta color to indicate the presence of flavanoids compounds.

Antimicrobial Activity

The sensitivity of pathogenic microorganisms to ethanol extracts were tested by measuring the zone of inhibition of given concentration of *Ficus racemosa* extracts by the well-diffusion method. The test organisms used were *Escherichia coli* (MTCC43), *Pseudomonas aeruginosa* (MTCC424), *Staphylococcus aureus* (MTCC96) and *Streptococcus mutans* (MTCC497). Clinical bacterial isolates the swabbed to Muller-Hinton agar plates method. They were punctured onto the agar plate. 50 mg/ml of ethanol extract with different concentrations (25 µl, 50 µl, 75 µl and 100 µl) were loaded into the wells. The petri-plates were incubated for 24 h, and the zone of inhibition was measured by around the wells.

Evaluation of mucoadhesive dental gel

All prepared dental gel formulations were evaluated for physical appearance, pH, viscosity, spreadability, syringeability, stability study, drug content, diffusion study, syringeability study in vitro mucoadhesive measurement.

Physical appearance

Gel formulations were visually to inspected for colour, odour, consistency, uniformity , grittiness , stickiness and homogeneity.

pH measurement

The pH of prepared gels was to determined by using a digital pH meter. The pH meter was calibrated before each use with standard pH 3 and pH 7 buffer solutions.

Viscosity

Viscosity of the prepared gels was measured by a Brookfield viscometer at 100 rpm, using spindle number 6 at 25°C. Samples of the gels were to settle over 30 min at the room temperature, before the measurements were taken. The test was performed for three times on each formulation.

Spreadability

Add 0.5 g of gel was placed in a circle of 1 cm diameter pre-marked on a glass plate over in which a second glass plate was placed on same. A weight of 100 g was allowed to the rest on upper glass plate. The increase in the diameter due to spread of gels was noted.

Drug content

48 h after preparation, one gram gel was taken in 10 ml volumetric flask, dissolved in water, make up the volume to 10 ml with water. Total phenolic content was determined by according to the Folin-Ciocalteu method. Absorbance values were measured at 756 nm. Concentrations of polyphenols were calculated from standard calibration curve of clove oil.

Syringeability study

The use of injectable systems was easy and rapid method. Syringeability of gel to formulations was evaluated by 21 G needle.

***In vitro* mucoadhesion measurement**

A significant characteristic of the gel is muco-adhesive strength for adhesion to the mucosa in dental pocket. A modified the tensiometry method was based on the Fisher's tensiometer was used to evaluate the mucoadhesive properties of the gel formulations. The limitation of the measurable surface tension or adhesive forces by this instrument was set at 0-100 dyne/cm².

A thin mica disk was placed on the tensiometer ring. 1% (w/v) solution of sodium alginate was placed into the 37°C water-jacketed glass vial of the instrument. After calibration of the tensiometer with a standard weight of 200 mg from each gel formulation was placed on mica disk and they was transferred to the tensiometer. The gel formulation came to contact with 1% (w/v) solution of sodium alginate for 5-10 min. Then the gel formulation was to detached from the solution of sodium alginate by 0.2 inch/min speed. The adhesion force between the mica disk and the solution of sodium alginate was used as the blank and considered in all tests. The detachment force was measured in terms of dyne/cm².

The test was performed for the six times on each of the formulation. After each experiment of the glass plate were removed and Palladium-Platinum ring of the tensiometer was washed with methanol and then acetone solution.

RESULTS AND DISCUSSION

The aerial part of *Ficus racemosa* were extracted by using soxhlet apparatus and yield 56% of crude extract with ethanol. The yield of phytochemical contents from plants depends on the nature of the solvent from non-polar to polar solvent. The ethanol extract of *Ficus racemosa* revealed to the presence of phytochemical constituents by including of phenols, flavanoids, quinines, tannins, saponins, steroids, alkaloids. The presence of phytochemicals in this plant extracts supports to bioactive compounds which might be responsible for therapeutic activities. The presence of phenols in the plant contributes to the preparation of some other antimicrobial compounds such as the dettol solution. The ethanol extract of *Ficus racemosa* showed the presence of tannins and alkaloids which helps in cancer prevention as well as remarkable cytotoxic and anticancer activity.

Table 2: Evaluation Parameters.

S. No	Parameter	F-1	F-2	F-3	F-4	F-5
1	pH	7	6.8	6.8	6.3	6.3
2	Viscosity (cps)	1800	2500	2874	3081	3212
3	Spreadability (cm)	2.3	2.3	2.4	2.5	2.5
4	Syringeability	Syringeable	Syringeable	Syringeable	Not Syringeable	Not Syringeable

Table 3: Phytochemical analysis of ethanol extracts.

S.no	Phytochemical test	Ethanol extracts
1	Phenols	Present
2	Flavonoids	Present
3	Quinones	Present
4	Tannins	Present
5	Saponins	Present
6	Cardiac glycosides	Absent
7	Steroids	Present
8	Alkaloids	Present
9	Terpenoids	Absent

CONCLUSION

The effective phytochemical constituents which are responsible for antimicrobial activity against various pathogenic microorganisms. The evaluation parameters of optimized batch indicate the prepared dental gel is mucoadhesive, stable, good delivery drug system

containing antimicrobial agents for prevention of dental caries, plaque formation, tooth aches and periodontitis.

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