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Research paper

Evaluation of Antibacterial Properties of *Streblus asper* Leaf Powder for Formulation of Medicinal Toothpaste

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ABSTRACT

Oral hygiene plays a vital role in maintaining overall health. Toothpaste is an essential oral care product used to remove dental plaque, prevent dental caries, and control gum diseases. Conventional toothpastes often contain chemical agents that may cause irritation or adverse effects with prolonged use. Hence, the present study focuses on the formulation and evaluation of a medicinal toothpaste using natural herbal ingredients such as *Streblus asper*, neem, clove, and peppermint. The antibacterial activity of *Streblus asper* leaf extract was evaluated against *Bacillus subtilis* using the well diffusion method. Six formulations were prepared by the trituration method, and among them, formulation F3 showed better consistency, stability and antibacterial effectiveness. The results suggest that medicinal toothpaste containing *Streblus asper* is effective in maintaining oral hygiene and reducing bacterial growth.

INTRODUCTION

Toothpaste is widely used to promote oral hygiene by removing dental plaque, food debris and preventing oral diseases such as dental caries and gingivitis. It also helps suppress halitosis and delivers active ingredients like fluoride (1). However, prolonged use of chemical-based toothpaste may lead to irritation and other health concerns. Medicinal or herbal toothpastes have gained popularity due to their natural antibacterial properties and reduced side effects. These

toothpastes contain plant-based ingredients such as *Streblus asper* and neem, which are known for their antimicrobial and anti-inflammatory effects. The present study aims to formulate a medicinal toothpaste using herbal extracts and evaluate its antibacterial activity (2).

MATERIALS AND METHOD

Materials

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Barinka leaf powder (*Streblus asper*), Neem leaf Powder, Clove oil, Peppermint oil, Calcium carbonate, Glycerin, Xanthan gum, Methyl cocyl taurate, Methyl paraben.

Collection of plants

The leaves of plants like *Streblus asper* and *Azadirachta indica* were collected from locally in Erraguntapally village of Telangana State. These leaves were washed under running water to remove contaminants. They are shade-dried for 7 days, ground into coarse powders, sieved using 60 meshes and stored in closed containers.

Preparation of Leaf extract

10 grams of dried *Streblus asper* leaves powder was soaked in 100ml of methanol and kept for two days with intermediate shaking. The mixture was filtered to separate solid plant debris and the

obtained filtrate was dried under sunlight to get the crude *Streblus asper* leaf extract.

METHODOLOGY

Antibacterial Activity of *Streblus asper* leaf powder

The antibacterial activity of *Streblus asper* leaf powder was evaluated using the Agar Well diffusion method against *Bacillus subtilis*. Agar plates were inoculated with bacterial culture, wells of 5 mm diameter were made and the wells were inoculated with 0.5mg/ml, 1mg/ml and 1.5mg/ml respectively. Plates were incubated at 37°C for 24 hours. The zone of inhibition was measured, showing a diameter of 1.2 ± 0.2 mm with 1.5mg/ml, confirming antibacterial activity for *Streblus asper* leaf powder as shown in Figure 2.

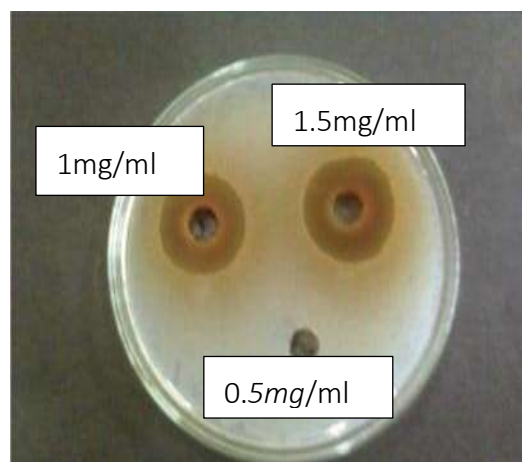


Figure 1: *Streblus asper* leaf

Method of Preparation of Toothpaste (3)

The medicinal toothpaste was prepared using the **trituration method**. Herbal powders were mixed in increasing order of proportion using a mortar

Figure 2: Zone of Inhibition showing Antibacterial activity by *Streblus asper* leaf



and pestle. Calcium carbonate, glycerine, methyl cocoyl taurate and xanthan gum were added and mixed thoroughly. Methyl paraben was incorporated as a preservative. Distilled water was added gradually to obtain a smooth paste as shown in Figure 3.



Figure 3: Medicinal tooth paste

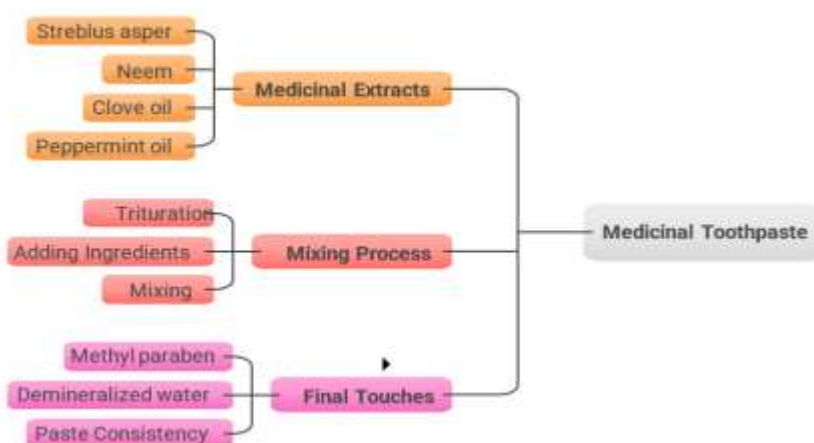


Figure 4: Preparation process of medicinal toothpaste

Table.1: Composition of medicinal toothpaste

Ingredient	Function	Quantity					
		F1	F2	F3	F4	F5	F6
Barinka (<i>Streblus asper</i>) powder	Antibacterial	0.3g	0.3g	0.3g	0.3g	0.3g	0.3g
Neem (<i>Azadirachta indica</i>) powder	Anti-inflammatory	0.5g	0.2g	0.2g	0.5g	0.4g	0.3g
Clove (<i>Eugenia caryophyllus</i>) oil	Analgesic, Antibacterial	2 drops	2 drops	2 drops	2 drops	2 drops	2 drops
Peppermint (<i>Mentha piperita</i>) oil	Antioxidant, Antimicrobial	0.3ml	0.5ml	0.4ml	0.2ml	0.4ml	0.6ml
Calcium carbonate	Polishing agent, plaque removal	25g	25g	30g	40g	25g	35g
Glycerin	Lubrication and smoothness	25ml	30ml	30ml	35ml	30ml	25ml
Xanthan gum	Thickening agent	2g	2g	2g	2.5g	3g	2.5g
Methyl cocoyl taurate	Foaming agent	2.5g	2.5g	2g	2.2g	3g	2.5g

Methyl paraben	Preservative	0.2g	0.2g	0.2g	0.2g	0.2g	0.2g
Distilled water	Solvent	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.

Evaluation parameters formulated herbal toothpaste (4)

Organoleptic Evaluation

Organoleptic properties were assessed using visual inspection such as color, odor, texture and appearance were recorded

Physicochemical Evaluation

The formulated toothpaste was evaluated for several physicochemical parameters

1. pH

10g of toothpaste was placed in a 150ml beaker. Add 10ml of hot water and then cooled it. Stir vigorously to form a suspension. The pH value should be recorded using a digital pH meter.

2. Foaming Ability

1 g toothpaste was mixed in 50 mL distilled water, shaken in a graduated cylinder, and foam height measured.

3. Spreadability (5)

Spreadability was determined using a Spreadability device composed of a wooden board with a scale and two glass slides with two pans on each side fixed on a pulley. Excess sample was sandwiched between two glass slides, and a 100 g weight was applied to the glass slide for 5 minutes to compress it to a uniform thickness. Weight (250 g) was added to the pan. The time in seconds necessary to separate the two slides was used to assess Spreadability.

Formula was used to calculate spreadability:

$$S=M \times L / T$$

Where, S= Spreadability M= Weight in the pan (tied to the upper slide) L= Length moved by the glass slide T=Time (sec) taken to separate the upper slide from the ground slide.

4. Extrudability

The prepared paste was filled into a typical capped collapsible aluminum tube and sealed by crimping the end. The weight of the tubes was noted. Clamps were used to hold the tubes between two glass slides. 500g was placed over the slides, and the cover was removed. The amount of extruded paste was collected and weighed. The percentage of extruded paste was calculated.

5. Gritty matter

A small amount of toothpaste was rubbed onto a piece of butter paper. The quantity and degree of scratches on the butter paper were categorized as absent or present.

6. Tube inertness

The toothpaste container should not corrode or deteriorate under standard storage settings, such as a heating temperature of $45 \pm 20^\circ\text{C}$ for 10 days. Tube inertness can be determined by cutting the internal surface open and observing for signs of deterioration or chemical attack in the container.

7. Determination of sharp and edge abrasive particles

Extrude the content 15-20 cm long onto the butter paper; repeat for at least ten collapsible tubes. Press the contents of the entire length with a



fingertip to detect the presence of sharp- and hard-edged abrasive particles. Toothpaste must not include such particles.

8. Determination of moisture and volatile matter

5 g of formulation was placed in a porcelain dish about 6-8 cm in diameter and 2-4 cm thickness. Dry the sample in an oven at 105 °C.

Calculation % by mass = $100 \frac{MI}{M}$

MI-Loss of mass(g) on drying M- Mass (g) of the material taken for the test

9. Viscosity

Brookfield viscometer used at room temperature (Spindle No. 64, 10 rpm).

RESULTS AND DISCUSSION (6)

Table 2: Organoleptic Evaluation

Parameter	Observation					
	F1	F2	F3	F4	F5	F6
Color	Whitish	Whitish	Whitish	Whitish	Whitish	Whitish
Odor	Characteristic spicy and aromatic fragrance	Characteristic spicy and aromatic fragrance	Characteristic spicy and aromatic fragrance	Characteristic spicy and aromatic fragrance	Characteristic spicy and aromatic fragrance	Characteristic spicy and aromatic fragrance
Texture	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
Appearance	Homogeneous	Homogeneous	Homogeneous	Homogeneous	Homogeneous	Homogeneous

Table 3: Physicochemical Evaluation

Parameter	Observation					
	F1	F2	F3	F4	F5	F6
pH	7.20±0.05	7.00±0.05	7.20±0.05	7.12±0.05	7.26±0.05	7.30±0.05
Foaming ability (%)	50	55	45	30	47	48
Spreadability (g·cm/s)	5	7	11	5	6	Improper
Extrudability (g)	60	65	76	73	70	66
Gritty matter	Absent	Absent	Absent	Absent	Absent	Absent
Tube inertness	Worst	Worst	Good	Good	Bad	Bad
Abrasive particles	No solid particle	No solid particle	No solid particle	No solid particle	No solid particle	No solid particle
Moisture and Volatile matter(%w/v)	33	34	25	33	40	40
Viscosity(cPs)	25,000±400	30,000±500	45,000±500	44,000±250	23,000±200	32,000±500

The zone of inhibition was measured, showing a diameter of 1.2 ± 0.2 mm with 1.5mg/ml,

confirming antibacterial activity for *Streblus asper* leaf powder. A medicinal tooth paste F1 to



F6 were prepared and evaluated. Organoleptic parameters were found to be proper for all formulations. Then physicochemical evaluation was performed. F1, F2 and F6 showed less extrudability, degradation of the preparation. Except F3 all formulations showed more volatility of the preparation and viscosity was also inadequate. From all the above observations made, F3 formulation showed better properties than all other.

CONCLUSION

The formulated medicinal toothpaste containing *Streblus asper* demonstrated significant antibacterial activity and effectiveness in maintaining oral hygiene. Compared to non-medicinal toothpaste, it showed better results in controlling gum bleeding and bacterial growth. Among the six formulations, **F3 was found to be the most effective and stable**. Hence, medicinal toothpaste with herbal ingredients can be considered a safer and effective alternative to conventional toothpaste.

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