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## Research Article

### FORMULATION AND EVALUATION OF HERBAL TOOTHPASTE

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#### ABSTRACT

The present study is concerned with the formulation and evaluation of herbal toothpaste, which contains various properties like tooth abrasives, tooth whitening, anti-caring, antibacterial, anti-inflammatory, desensitivity, etc. The herbal toothpaste was prepared using mango leaf extract and guava leaf extract as active ingredients, along with various excipients, which include calcium carbonate, sodium chloride, sodium lauryl sulphate, sodium benzoate, glycerine, camphor, honey and distilled water. The toothpaste was prepared by homogeneous mixing of all the excipients and the herbal extract. Four formulations were prepared using mango leaf extract as an active ingredient along with varying excipient concentrations, four formulations were prepared using guava leaf extract as an active ingredient along with varying excipient concentrations, and a polyherbal formulation consisting of four formulations containing both mango leaf extract and guava leaves extract as active ingredients along with varying excipient concentrations. The formulations were tested for various parameters such as homogeneity, abrasiveness, foamability, moisture content, Spreadability, extrudability, colour, PH, and antibacterial activity. The study concluded that polyherbal formulation showed best results and was found to be best among all batches. The polyherbal formulation, F4 showed was found to be best among all other formulations.

Keywords: Mango leaf extract, guava leaf extract, antibacterial activity, abrasive, anti-caring.

#### INTRODUCTION

Toothpaste is a formulation that promotes the attractiveness of teeth and maintains teeth health. The toothpaste can deliver the active ingredients that remove plaque build-up and treat dentine hypersensitivity and dental hygiene.<sup>1</sup> It has various other functions like refreshing breath, removal of food particles, polishing of tooth surface with the help of toothbrushes and other therapeutic activities such as whitening, bleaching, desensitising, and protection against periodontal problems.<sup>2</sup> The active substances present in toothpaste can prevent dental diseases. Toothpaste also helps control bad breath and provides active ingredients (most commonly fluoride) to prevent tooth decay (cavities) and gum disease (gingivitis). Due to differences in composition and fluoride content, not all toothpastes are equally effective in maintaining oral health. Toothpaste containing natural ingredients is more acceptable than chemical-based because of its safety and effectiveness in dental care.<sup>3</sup> The main reason is to prevent dental diseases such as gingivitis, cavities, and gum disease.

In this formulation, we use mango leaves as an active ingredient that exhibits various medicinal properties that can be used in the formulation of toothpaste. Mango leaves strengthen gums and teeth whitening and showcase potent antibacterial properties against *Streptococci* and *Escherichia coli* strains.<sup>4</sup> Enriched with mangiferin, phenolic acids, benzophenones, and antioxidants like flavonoids, carotenoids, quercetin, isoquercetin, ascorbic acid, and tocopherols, mango leaves prove valuable in tooth brushing, treating toothaches, and even finding applications in mouthwashes. Guava leaves are another significant ingredient, complementing the formulation with demonstrated anti-inflammatory and antibacterial activities. Known to combat infections, eliminate germs, and alleviate sore throats, guava leaf juice relieves swollen gums and mouth ulcers.<sup>5</sup> The rich phytochemical composition of guava leaves includes alkaloids, phenols, flavonoids, saponins, tannins, and triterpenoids.

The present research work aims to formulate an herbal toothpaste containing a combination of mango leaves extract, and guava leaves extract, which has multiple activities and also complies with the required conditions and shows better activity compared to the batch of herbal toothpaste containing only a single active ingredient either mango leaves extract or guava leaves extract.

## MATERIALS AND METHODS

Table 1: Excipients and herbal ingredients with their roles

Ingredients	Roles
Mango leaf extract powder	Whitening of teethes and protecting the teethes
Guava leaf extract powder	Acts as analgesic for pain due to inflammation in teeth
Calcium carbonate	Thickening and opacifying agent
Sodium chloride	Tooth abrasive and remove stains from the teeth
Sodium lauryl sulphate	Acts as a foaming agent
Sodium benzoate	Acts as preservative
Glycerine	Humectant and moistening agent
Camphor	It helps to relieve toothache and freshen the breath.
Honey	Antibacterial and sweetening agent
Distilled water	Acts as solvent

**Collection of plant materials:** Leaves from mango trees and guava trees were collected from Pilikula Botanical Garden Mangalore.

**Authentication of plant materials:** The authentication of the leaves of the plant *Mangifera indica* and *Psidium guajava* was done by the Department of Applied Botany of Mangalore University, Mangalore – 574199, Karnataka, India.

**Authenticated by:** Dr. Krishnakumar, Professor, Department of Applied Botany, Mangalore University, Mangalagangothri-574199.

**Extraction processes:**

**Extraction of *Mangifera indica* leaves:** Collected leaves of *Mangifera indica* were thoroughly washed with cold water and were shade-dried for one month. With the help of an electrical grinder, the size reduction of the dried leaves was done, and to get a uniform size, the powder was passed through a sieve number 83 $\mu$ . About 25 g of the powder was taken in a conical flask with a stopper cork, the maceration process, and ethanol as a solvent for three days. Filter it to collect the filtrate. After collecting the filtrate, it was evaporated to dry to get powder extract.<sup>6</sup>

**Extraction of *Psidium guajava* leaves:** Collected leaves of *Psidium guajava* were thoroughly washed with cold water and shade-dried for one month. The size reduction process was mainly done with the help of an electric grinder, and powder was passed through sieve number 83 $\mu$  to get a uniform size. About 20gm of powder was taken in a conical flask with a stopper cork, the maceration process, and ethanol as a solvent for about three days. Filter it to collect the filtrate. After collecting the filtrate, it was evaporated to get dried to get powder extract.<sup>7</sup>

Method for preparation of herbal toothpaste using various active ingredients: The required excipients for the preparation include Calcium carbonate, camphor, honey, glycerine, sodium benzoate, sodium lauryl sulphate, distilled water, and sodium chloride are weighed according to the required quantity.

Add sodium chloride, camphor, calcium carbonate, and sodium lauryl sulphate in the mortar and pestle with sufficient amount, then triturate well to get a homogeneous mixture, then add humectants such as glycerin and honey and again triturate with distilled water.

Add extract for the above homogeneous mixture, then triturate well until a paste-like consistency forms. Then, the prepared paste is labelled in a suitable container.

Table 2: Formulation of herbal toothpaste using *Mangifera indica*

Ingredients	F <sub>1</sub> (%)	F <sub>2</sub> (%)	F <sub>3</sub> (%)	F <sub>4</sub> (%)
Mango leaf extract powder	1gm	1.5gm	1.8gm	2.1g
Sodium chloride	0.2ml	0.2ml	0.2ml	0.2ml
Calcium carbonate	3.5gm	3.5gm	3.5gm	3.5gm
Sodium benzoate	0.3gm	0.3gm	0.3gm	0.3gm
Honey	0.5gm	0.5gm	0.5gm	0.5gm
Sodium lauryl sulphate	0.5gm	0.5gm	0.5gm	0.5gm
Camphor	0.5ml	0.5m	0.5m	0.5m
Glycerin	2ml	2ml	2ml	2ml
Distilled water	1.5ml	1ml	0.7ml	0.4ml





Figure 1: Preparation of *Mangifera indica* herbal toothpaste

Table 3: Formulation of herbal toothpaste using *Psidium guajava*

Ingredients	F <sub>1</sub> (%)	F <sub>2</sub> (%)	F <sub>3</sub> (%)	F <sub>4</sub> (%)
Guava leaf extract powder	1gm	1.5gm	1.8gm	2.1g
Calcium carbonate	3.5gm	3.5gm	3.5gm	3.5gm
Sodium chloride	0.2gm	0.2gm	0.2gm	0.2gm
Sodium lauryl sulphate	0.5gm	0.5gm	0.5gm	0.5gm
Camphor	0.5gm	0.5gm	0.5gm	0.5gm
Sodium benzoate	0.3gm	0.3gm	0.3gm	0.3gm
Glycerin	2.0ml	2.0ml	2.0ml	2.0ml
Honey	0.5ml	0.5ml	0.5ml	0.5ml
Distilled water	1.5ml	1ml	0.7ml	0.4ml



Figure 2: Preparation of *Psidium guajava* herbal toothpaste

Table 4: Formulation of polyherbal toothpaste

Ingredients	F <sub>1</sub> (%)	F <sub>2</sub> (%)	F <sub>3</sub> (%)	F <sub>4</sub> (%)
Mango leaf extract powder	0.5gm	0.75gm	0.9gm	1.05gm
Guava leaf extract powder	0.5gm	0.75gm	0.9gm	1.05gm
Calcium carbonate	3.5gm	3.5gm	3.5gm	3.5gm
Sodium chloride	0.2gm	0.2gm	0.2gm	0.2gm
Sodium lauryl sulphate	0.5gm	0.5gm	0.5gm	0.5gm
Sodium benzoate	0.3gm	0.3gm	0.3gm	0.3gm
Glycerin	2.0ml	2.0ml	2.0ml	2.0ml
Camphor	0.5ml	0.5ml	0.5ml	0.5ml
Honey	0.5ml	0.5ml	0.5ml	0.5ml
Distilled water	1.5ml	1ml	0.7ml	0.4ml



Figure 3: Preparation of polyherbal toothpaste

**Evaluation of herbal toothpaste**<sup>8-10</sup>

**pH:** The pH of the herbal toothpaste formulation can be determined using a pH meter. 5 gm of formulated herbal toothpaste can be placed in 150 ml of beaker. Make suspension by vigorously stirring. Then, find pH.

**Homogeneity:** The toothpaste can extrude a homogeneous mass from the collapsible tube or any other suitable container by applying pressure or force.

**Determination of sharp and edged particles:** Extrude the content up to 15 to 20cm on the butter paper, and press the contents present in the entire length with the help of a fingertip to determine the presence of sharp-edged particles in formulation.

**Foamability:** Foamability of formulated herbal toothpaste can be determined by taking 2gm of toothpaste in 50ml of water in a measuring cylinder, the initial volume is noted, then shaking the cylinder for up to 10 minutes. Then, foam can be determined.

**Determination of moisture and volatile substance:** It can be done by taking 5gm of toothpaste and placing it in a glass plate, then spreading the formulation on a glass plate with a diameter of 6cm. Then, dry the formulation, which is set on a glass plate in a hot air oven at 105 degrees centigrade until constant weight is obtained.

**Formula for calculation**

Calculation percentage by mass=100MI/M  
 MI –loss of mass on drying the formulation.  
 M- Mass of the substance taken for the test.

**Spreadability:** It can be done by taking about 1 gm of formulated herbal toothpaste, which can be weighed at the centre of the glass

plate. Then, place another glass plate over it carefully. At the centre of the glass plate, 2kg weight can be set for 30 minutes. After that, the diameter of the paste, which is spread on a glass plate, is measured. This can continue till the average diameter of the paste can be obtained.

**Stability study:** The stability of toothpaste can be determined by exposing it to 20 to 45 degrees centigrade for 28 days. If there is no phase separation, fermentation and gassing can be observed. Here, toothpaste can be exposed to relaxed conditions, such as 50 degrees centigrade for 1 hour. Then, find the stability of toothpaste.

**Antibacterial study:**

**Test Microorganism:** Pure cultures of *Staphylococcus aureus* and *Escherichia coli* were obtained from the Department of Microbiology and Biotechnology of Mangalore University.

**Inoculum preparation:** 10ml of distilled water was taken in a test tube, and a loopful pure colony of freshly cultured bacteria of the experimental species were added into a test tube. OD (optical density) was measured to confirm the population density of 100-110 per ml.

**Test solution preparation:** The extract was dissolved in 9 ml of distilled water. Crude extract disks were prepared in different concentrations of ethanol.

**Disk diffusion method:** The sterile nutrient agar was poured into Petridis and uniformly spread. Then, 0.1ml of test culture was uniformly distributed over an agar medium. Clean-prepared disks were placed on agar plates, incubated at 37 inhibitions, and measured using an antibiotic zone scale.

**Table 5: Physical Parameters of *Mangifera indica* herbal toothpaste**

Parameters	Observation
Colour	Greenish
Odor	Characteristics
Taste	Characteristic
Appearance	Smoothness with good consistency

**Table 6: Observation Of Evaluation Parameters of *Mangifera indica* herbal toothpaste**

Parameter	F1	F2	F3	F4
Colour	Green	Green	Green	Green
PH	7.5	7.5	7.7	7.8
Homogeneity	Good	Good	Good	Good
Abrasiveness	Good	Good	Good	Very good
Foamability	13ml	13ml	13ml	13 ml
Moisture content	1.64% w/v	1.71% w/v	1.68% w/v	1.2% w/v
Extrudability	89.5g	89.5g	89.5g	89.5g
Antibacterial activity	14-17 mm	16-19 mm	17-20 mm	18-21 mm
Spreadability	3.5cm/sec	3cm/sec	3.5cm/sec	3.5cm/sec

**Table 7: Physical parameters of *Psidium guajava***

Parameter	Observation
Colour	Greenish
Odor	Characteristics
Taste	Characteristic
Appearance	Smoothness with good consistency

**Table 8: Observation of Evaluation Parameters of *Psidium guajava* herbal toothpaste**

Parameter	F1	F2	F3	F4
Colour	Green	Green	Green	Green
pH	7.5	7.5	7.7	7.8
Homogeneity	Good	Good	Good	Good
Abrasiveness	Good	Good	Good	Very good
Foamability	13ml	13ml	13ml	13 ml
Moisture	1.6% w/v	1.61% w/v	1.54% w/v	1.31% w/v
Extrudability	89.5g	89.5g	89.5g	89.5g
Antibacterial activity	14-17 mm	16-19 mm	17-20 mm	18-21 mm
Spreadability	3.5cm/sec	3.3cm/sec	3.3cm/sec	3.5cm/sec

**Table 9: Physical parameter of a polyherbal toothpaste product**

Colour	Greenish
Odor	Characteristics
Taste	Characteristic and Bitter
Appearance	Smoothness with good consistency

**Table 10: Observation and evaluation of polyherbal toothpaste product**

Parameter	F1	F2	F3	F4
Colour	Green	Green	Green	Green
pH	7.5	7.5	7.7	7.8
Homogeneity	Good	Good	Good	Good
Abrasiveness	Good	Good	Good	Very good
Foamability	13ml	13ml	10ml	13 ml
Moisture content	1.84% w/v	1.5% w/v	1.43% w/v	1.2% w/v
Extrudability	89.5g	89.5g	89.5g	89.5g
Antibacterial activity	16-19 mm	17-20 mm	18-21 mm	20-23 mm
Spreadability	3.5cm/sec	3.3cm/sec	3.5cm/sec	3.5cm/sec

## RESULTS

All developed formulations were homogeneous, smooth in appearance, and greenish in colour with characteristic odour and taste along with good spreadability. The studies showed that the F4 formulation complied with the requirement of physical parameters and was the best among all batches. (Table 7, 8)

All developed formulations were homogeneous, smooth in appearance, and greenish in colour, with a characteristic odour and slightly bitter taste along with good spreadability. The studies showed that the F4 formulation complied with the requirement of physical parameters and was the best among all batches. (Table 9, 10)

## DISCUSSION

From the above experiment, it has been found that the leaves of *Mangifera indica* extract have excellent teeth-whitening properties and antibacterial properties. In this experiment, sodium benzoate acts as a preservative, honey is used as an emollient, sodium chloride can be used as teeth abrasive, calcium chloride can be used as a thickening agent and also acts as an opacifying agent, glycerin also can be used as humectants, camphor can be used to relieve the toothache and freshen breath, distilled water can be used as a solvent for all the preparation of formulation. With all the above ingredients, a good form of herbal toothpaste is mainly prepared, which can be used to treat teeth disorders and whiten teeth. The experiment specifically includes the preparation of toothpaste with polyherbal. First, we prepared *Mangifera indica* herbal toothpaste, formulated and observed with good results. The evaluation parameters are also carried out to check the formulation's stability, consistency, pH and foamability. An excellent result which has been mainly obtained during the study period. It was also found that safety and effective results are also approached from the preparation. The experiment

also includes the formulation and evaluation of *Psidium guajava* herbal toothpaste. It is another active ingredient that can be used to formulate herbal toothpaste. It has excellent antibacterial properties and can be used in toothpaste to treat tooth disorders. This also provides good results, and various evaluation studies can be performed that result in safe and effective formulation. The main objective of this experiment title indicates the formulation and evaluation of polyherbal toothpaste. A combination of mango and guava leaf extract is mainly used for polyherbal preparation. In this formulation, different proportions of extracts, excipients, or additives are used in the required quantity. The formulation is slightly different in colour from the other two single *Mangifera indica* and *Psidium guajava* toothpaste formulations. By analysing the final result, these combined formulations are observed to produce better, safer and more effective results in maintaining good teeth health and whitening teeth because a single active ingredient formulation has single effects on teeth such that the *Mangifera indica* has antibacterial properties. *Psidium guajava* has antibacterial and antioxidant properties but combining these in a single formulation has multiple effects. It has also shown better results due to having various active ingredients.

## CONCLUSION

From the present study, it can be concluded that the polyherbal herbal toothpaste prepared from the different plants mentioned above is acceptable given its appearance, Spreadability and other physical parameters such as pH, foamability, stability, moisture and volatile substance of herbal toothpaste and offers good results which are stable at room temperature. All the formulated products have good appearance and spreadability and obey other physical parameters such as pH, foamability, stability, and moisture content. They were found safe for oral use. From the formulated products, a polyherbal toothpaste formulation containing mango leaf extract and guava leaf extract showed better results than the

formulation containing a single active ingredient. From the above study, it can be concluded that polyherbal toothpaste provides better results than herbal toothpaste containing single ingredients.

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#### REFERENCES

1. Mangilal T., Ravikumar M. Preparation and Evaluation of Herbal Toothpaste and Comparison with Commercial Herbal Toothpaste: An In vitro Study. International Journal of Ayurvedic and Herbal Medicine. 2016;6(3):2266-2273.
2. Banani RC, Arnav G, Madhuparna D, Bhattacharya S. Herbal toothpaste-A possible remedy for oral cancer. Journal of Natural Products, 2013; 6: 44-55.
3. Sadeghi-Nejad B, Moghimipour E, Yusef Naanaie S, Nezarat S. Antifungal and antibacterial activities of polyherbal toothpaste against oral pathogens, in vitro. Curr Med Mycol. 2018 Jun;4(2):21-26. doi: 10.18502/cmm.4.2.65.
4. T. Mangilal, M. Ravikumar. Preparation And Evaluation of Herbal Toothpaste and Compared with Commercial Herbal Toothpastes: An In vitro Study. International Journal of Ayurvedic and Herbal Medicine 2016; 6: 2266 –2251.
5. Garode AM., Waghmode SM. Antibacterial Activity of *Psidium guajava* Linn (Guava) Leaves Extract on Bacterial Pathogen—International Journal of Bioassay 2014; 3920:1794-1796.
6. Karadağlıoğlu Öİ, Ulusoy N, Başer KHC, Hanoğlu A, Şık İ. Antibacterial Activities of Herbal Toothpastes Combined with Essential Oils against *Streptococcus mutans*. Pathogens. 2019 Feb 1;8(1):20. doi: 10.3390/pathogens8010020.
7. Janakiram C, Venkitachalam R, Fontelo P, Iafolla TJ, Dye BA. Effectiveness of herbal oral care products in reducing dental plaque & gingivitis - a systematic review and meta-analysis. BMC Complement Med Ther. 2020 Feb 11;20(1):43. doi: 10.1186/s12906-020-2812-1. PMID: 32046707; PMCID: PMC7076867.
8. Shanmugapriya R, Arunmozhi U, Kadhiresan R, Sabitha S, Anirudhya R, Sujatha G. Comparison of antiplaque effectiveness of herbal toothpaste: A randomized triple-blinded cross-over clinical trial. Ayu. 2019 Apr-Jun;40(2):109-113. doi: 10.4103/ayu.AYU\_185\_19.
9. Gautam, D, Preetam P, Maule K, Shilpa S, Gopika S, Chinmay K et al., Evaluation and Comparison of Herbal toothpaste with marketed Herbal toothpaste. Asian J. Pharm. Tech, 2020; 10(3): 165-69.
10. Roshan T., Pavan D., Mahendra G. formulation and evaluation of herbal toothpaste: compared with marketed preparation. International journal of Pharmaceutics and drug analysis. 2017,5(10),406-410.
11. Sadeghi-Nejad B, Moghimipour E, Yusef Naanaie S, Nezarat S. Antifungal and antibacterial activities of polyherbal toothpaste against oral pathogens, in vitro. Curr Med Mycol. 2018 Jun;4(2):21-26. doi: 10.18502/cmm.4.2.65.
12. T. Mangilal, M. Ravikumar. Preparation And Evaluation of Herbal Toothpaste and Compared with Commercial Herbal Toothpastes: An In vitro Study. International Journal of Ayurvedic and Herbal Medicine 2016; 6: 2266 –2251.

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