



Formulation and Evaluation Study on Herbal Toothpaste : A Review

Nikita M. Rathi, Shital V. Sirsat, Sanket S. Toshniwal, Nikita T. Zagare, Shaikh Fazil Shaikh Mahamad
nmrathi43@gmail.com, vijshi2006@gmail.com, sankettoshniwal777@gmail.com
nikitazagare5@gmail.com, shaikhfazil393@gmail.com

Abstract:

Toothpaste is commonly used product by all individuals. Toothpaste is generally used for cleaning of teeth and mouth. It is also used to treat many disorders of teeth. Many dentists recommend to use toothpaste to treat disorder like sensitivity, Chronic gingivitis etc.

Herbal toothpastes can be prepared using different herbal extract of many crude drugs having antibacterial, antimicrobial activity.

Herbal formulation of toothpastes are prepared using herbs like ginger, Cassia simmia, Celastrus paniculata, Vateria indica extracts, Babul leaves extract, Ginger extract, Lemon oil extract, Neem stem & bark, Babul leaves, Gauva leaves, Kalmi bark etc.

These herbal toothpastes can be evaluated by different tests like Physical Examination, Relative density, Abrasiveness, Determination of spreadability, pH determination, Homogeneity, Foaming, Stability, Determination of moisture and volatile matter, Moisture content, Foaming character, Organoleptic evaluation, pH, Fragrance test, Shape retention, Storage stability, Total flavonoid content estimation of Tooth paste Formulation, Stability study (Storage stability), Antimicrobial activity of toothpaste etc.

The main objective of this review article is to compile the available information related to herbal toothpaste like its introduction, different formulations and different parameters on which these herbal toothpastes can be evaluated. This information can be used by many researcher who wants to make research in this area.

Key words: Herbal toothpaste, Ginger, Neem, Kalmi Bark, Guava Leaves

Introduction:

Toothpastes are the most common preventive means in oral health care. Many commercially available dentifrices claim to have antimicrobial properties, but little research has been conducted to investigate these claims. Therefore, this study was conducted to evaluate the efficacy of different toothpaste formulations in reducing the oral microbial load. The selected tooth paste formulations were effective in controlling the microbial load and therefore contributing to maintain good oral hygiene. However, practicing appropriate oral hygiene measures & brushing technique is of utmost importance in maintaining good oral health than the effectiveness of various ingredients in the toothpastes used.¹

Chronic gingivitis is one of the most common oral diseases with high prevalence around the world. Dental plaque is the major etiological and initiating factor for the development of gingivitis. However, due to the limitation of mechanical methods, the addition of some safe and effective drugs to prevent gingivitis in toothpaste is also considered to be a good supplementary to the control of mechanical plaque. Studies have

shown that certain chemicals, such as chlorhexidine or triclosan, are added to the toothpaste to directly inhibit the formation of plaque²

Various chemical agents have been used in toothpastes and mouth rinses and a few have been shown to reduce dental plaque formation. Due to an increased awareness of indigenous medical practices in various parts of the world, the use of “herbal” medicine has engendered interest and facilitated the growth of complementary and alternative therapies in health care promotion.³

The main purpose of toothpaste is to reduce oral bacterial flora and deliver fluoride to the teeth. This is because fluoride has been proven to protect teeth against attack from bacteria and can be found naturally in many everyday things including food and drinkinwater. Toothpaste that efficiently reduces oral bacterial flora should contribute to dental health. Triclosan is usually used in gum. It is a constituent used to avert gum disease because of its antibacterial properties. The active ingredient sodium fluoride is also known to have antibacterial propertiesNatural toothpastes are those without triclosan or fluoride. They usually contain natural ingredients such as special mineral salts e.g. Sodium Fluoride and Sodium Chloride, and plant extracts like lemon, eucalyptus, rosemary, chamomile, sage and myrrh.⁴

Formulations:

1. Formulation of Ginger Toothpaste:

Sr.no	Ingredients(gm)	Quantity(w/w) %
1	Ginger oil(ACTIVE INGREDIENT)	2ml
2	Sodium lauryl sulphate	1.5gm
3	Sodium benzoate	0.1gm
4	Sodium saccharine	0.2gm
5	Glycerin	40ml
6	Calcium carbonate	44gm
7	Pepper mint oil	Qs

Preparation of base

1. The solid ingredients calcium carbonate, sodium lauryl sulphate, glycerin, sodiumbenzoate, sodium saccharine were weighed accurately as mentioned in the formula and sieved with sieve no.80 so as to maintain the particle size.
2. These ingredients were also mixed in a mortar and pestle, then triturated with precisely weighed glycerin until a semisolid substance was created.
3. Addition of herbal ingredients-
4. Accurately weighed herbal extract in form of ginger oil were added to the base
5. At the end, peppermint oil was added as a flavor⁵

2. Formulation of herbal toothpaste

Formulation

All herbal ingredient were dried and grounded using domestic mixer. The required quantity of ingredients were weighed and taken in mortar. Calcium carbonate, Sodium lauryl sulfate, methyl cellulose, honey and glycerine were mixed in water. Acacia were added into the above mixture. This solution was added drop wise into mortar containing herbal ingredients and triturated well until a paste consistency is formed⁶

Composition:

Sr. No	Ingredient	Quantity(g)
1	Neem stem & bark	0.5
2	Babul leaves	0.5
3	Gauva leaves	0.5
4	Kalmi bark	0.5
5	Camphor	0.5
6	Honey	0.5
7	Calcium carbonate	3.5
8	Glycerine	2.0
9	Para hydroxyl benzoic acid	0.3
10	Sodium lauryl sulfate	0.5
11	Sodium chloride	0.2
12	Distilled water	q. s.

3. Formulation of polyherbal toothpaste:

The poly-herbal toothpaste was prepared using Cassia simmia plant (pods), Celastrus paniculata (leaves), Vateria indica (gum resin) babul (leaves) are acts as possessing antibacterial properties and anti-inflammatory properties.

Ginger (rhizome), lemon oil acts as a antiseptic activity, turmeric acts as antimicrobial and anti-inflammatory properties, calcium carbonate acts as a abrasive agent, glycerine acts as humectants sodium lauryl sulphate as detergent, sodium saccharin acts as a sweetening agent, para hydroxyl benzoic acid is used for preservative, menthol used for flavouring agent amaranthacts as a colouring agent and water as aqueous media. All above herbal extract was used to formulate the poly-herbal toothpaste.⁷

Sr. no	Ingredients	Quantity (%)
1	Cassia simmia, Celastrus paniculata, Vateria indica extracts	9
2	Babul leaves extract	3
3	Ginger extract	4
4	Lemon oil extract	3
5	Sodium saccharin	0.25
6	Turmeric extract	3
7	Para-hydroxyl benzoic acid	0.1
8	Amaranth	0.50
9	Calcium carbonate	35
10	Glycerin	25
11	Sodium lauryl sulphate	1
12	Menthol	1.5

13	Water	Q.S
----	-------	-----

4. Formulation of Polyherbal Toothpaste:

Carboxymethyl cellulose was triturated with methyl paraben and propyl paraben by using mortar and pestle. Sodium Lauryl Sulphate was dissolved in 25 ml of demineralized water and added sufficiently along with 5 g of glycerin. The mixture was triturated well. Finally, calcium carbonate and peel extracts of pomegranate, mango, and lemon have added the mixture and triturated to form a paste. Lastly, few drops of mint oil were added to mask the taste.

The composition of herbal toothpaste was shown in table ⁸

Sr. No.	Components	Amount (g)
1	Pomegranate peel extract	5.0 g
2	Lemon peel extract	5.0 g
3	Mango peel extract	5.0 g
4	Carboxymethyl cellulose	3 g
5	Calcium carbonate	20 g
6	Glycerine	5 g
7	Methylparaben	0.5 g
8	Propylparaben	0.25 g
9	Sodium Lauryl Sulphate	1 g
10	Mint oil	0.5%
11	Demineralized water	25 ml

Evaluation of Toothpaste

1. Physical Examination

- Colour- Formulated toothpaste was evaluated for its colour.
- The visually colour was checked.
- Odour- Odour was found by smelling the product.
- Taste- Taste was checked manually by tasting the formulation

2. Relative density

Relative density was determine by weight in gram taken in 10 ml formulation and 10 ml distilledwater using RD bottle Evaluation Parameters

3. Abrasiveness

Extrude the content 15-20 cm long on the butter paper, repeat the same process for at least ten collapsible tubes. Press with the contents of the entire length with fingertip for the presence of sharp andhard edged abrasive particles. Toothpaste shall not contain such particles.

4. Determination of spreadability

In this method slip and drag characteristic of paste involve. Formulated paste (2g) placed on the ground slide under study. The formulated paste placed like sandwich between this slide and another glass slides for 5min to expel air and to provide a uniform film of the paste between slides. Excess of the paste was scrapped off from the edges. The top plate was then subjected to pull of 80g with the help of string attached to the hook and time (sec) required by the top slide to cover a distance of 7.5cm was noted. A short interval indicated better 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.

5. pH determination

pH of formulated herbal toothpaste was determined by using pH meter. 10g of toothpaste placed in 150ml of beaker. Allow the 10ml of boiled and then cooled water. Stir vigorously to make a suspension.

6. Homogeneity

The toothpaste shall extrude a homogenous mass from the collapsible tube or any suitable container by applying of normal force at $27 \pm 20^\circ\text{C}$. in addition bulk of contents shall extrude from the crimp of container and then rolled it gradually.

7. Foaming

The foamability of formulated toothpaste evaluated by taking small amount of formulation with water in measuring cylinder initial volume was noted and then shaken for 10 times. Final volume of foam was noted

Determination of froth power

$$\text{Foaming power} = V_1 - V_2$$

V1- Volume in ml of foam with water.

V2- Volume in ml of water only.

8. Stability

The stability study was performed as per ICH guideline. The formulated paste was filled in collapsible tube and stored at different temperature and humidity conditions, $25^\circ\text{C} \pm 2^\circ\text{C} / 60\% \pm 5\% \text{RH}$, $30^\circ\text{C} \pm 2^\circ\text{C} / 65\% \pm 5\% \text{RH}$, $40^\circ\text{C} \pm 2^\circ\text{C} / 75\% \pm 5\% \text{RH}$ for the period of three months and studied for appearance, pH and spreadability.

9. Determination of moisture and volatile matter

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

Calculation

By mass = $100 \text{MI} / \text{M MI}$ -Loss of mass (g) on drying

M- Mass (g) of the material taken for the test.⁹

10. Moisture content

Toothpaste (10 gm) weighted in a Porcelain dish and dried it in the oven at 105°C . It was cooled in a desiccater. The loss of weight is recorded as percentage moisture content and calculated by the given formula.

$$\% \text{ Moisture} = \frac{\text{Original sample weight} - \text{dry sample weight}}{\text{Original sample weight}}$$

11. Foaming character

1) 1 gm of tooth paste was poured into stoppered test tube (height 16 cm. diameter 6 mm) and volume of the liquid was adjusted with the water up to 10 ml. Tube was stoppered and shaken length wish, motion for 16 second, two shake/second. Allowed to stand for 15 minutes and height of the foam produced was measured.

2) 10% solution of tooth paste was prepared. 4ml of this solution was added to 146 ml of water at 30°C . The solution was agitated for 10 seconds. The foam was poured in to a 100 ml graduated cylinder to overflowing. A rubber stopper was gently dropped in to the foam. The time for the rubber stopper to pass two points (40ml-80ml) was measured. Longer time of fall indicates the denser and more stable foam.

12. Organoleptic evaluation

Organoleptic evaluation (colour, taste) was done by sensory and visual inspection.

13. pH

pH was tested by dissolving 1 gm product in to 9 ml of water and shaken vigorously then aqueous solution and pH is observed by pH meter.

14. Fragrance test

It was based on individual observation for its acceptability. 5 people were asked for acceptability of fragrance and their opinion was taken. And fragrance was evaluated based on the below-described criteria;

- A) The fragrance was good, as good as the fragrance of reference toothpaste.
- B) The fragrance was not so good but comparable to the reference toothpaste.
- C) The fragrance of the toothpaste was poor than the reference toothpaste.

15. Shape retention

Tooth paste was squeezed out from the tube and put entirely of a tooth brush and the state of the toothpaste after it was allowed to stand for 10 seconds was evaluated based on the below-described criteria;

- A) Shape just after the toothpaste is squeezed out on the toothbrush is maintained.
- B) Shape just after the toothpaste is squeezed out on the toothbrush is almost maintained.
- C) The toothpaste squeezed from the toothbrush and cannot maintain its shape.

16. Storage stability

The toothpaste were filled in a toothpaste tube for storage and stored for 45 days at each of 5 °C, room temperature and 40 °C. The tube was then cut through and whether the liquid component was separated from the toothpaste or not was evaluated based on following criteria.

Evaluation criteria of storage stability;

- A) Separation of a liquid component is not observed at all.
- B) Separation of a liquid component is observed slightly.
- C) Separation of a liquid component is observed obviously.

Net content: net content was calculated by using following formula;

Net content = weight of filled tube – weight of empty tube.

17. Total flavonoid content estimation of Tooth paste Formulation

1 ml of 2% AlCl₃ solution was added to 3 ml of stock solution of tooth paste and allowed to stand for 15 min at room temperature; absorbance was measured at 420 nm.

18. Stability study (Storage stability)

Toothpaste was stored at 40 °C and RH 75% ± 5% for 45 days. Estimation of Flavonoids was performed at zero period and then samples were withdrawn after every 9 days, total 5 samples were withdrawn. Toothpaste (1 gm) was refluxed with distilled water (75 ml) for 30 min. for complete extraction of flavonoids and filtered through sintered glass funnel by vacuum filtration assembly. The filtrate was centrifuged at 2000 rpm for 20 minutes, the supernatant was collected in 100 ml volumetric flask and volume was made up with water. The same procedure was performed for each sample and solutions (100 ml) of their Total flavonoids content were determined.

19. Antimicrobial activity of toothpaste

The well diffusion method was used to determine the antimicrobial activity of the Toothpaste using standard procedure of Bauer et al 24 .The drug used in standard preparation was ofloxacin and ciprofloxacin of IP grade. The antimicrobial activity was performed by using 24hr culture of S. Mutans and S. aureus. There were 3 concentration used which are 25, 50 and 100mg/ml for each extracted phytochemicals in antibiogram studies. It's essential feature is the placing of wells with the antibiotics on the surfaces of agar immediately after inoculation with the organism tested. Undiluted over night broth cultures should never be used as an inoculums. The plates were incubated at 37 °C for 24 hr. and then examined for clear zones of inhibition around the wells

impregnated with particular concentration of drug. The diameter of zone of inhibition of each wall was recorded.
10

References:

1. Priyal G. 1 , Maji Jose 2 , Shruti Nayak 3 , Vidya Pai 4 , Sudeendra Prabhu, Evaluation of efficacy of different tooth paste formulations in reducing the oral microbial load - An in vivo study, *Biomedicine*: 2021; 41(2) Supplementary issue: 465-471
2. Jinfeng He, Yalan Deng, Fangzhi Zhu, Ting Zhong, Nanyu Luo, Lei Lei, Li Cheng , and Tao Hu, The Efficacy and Safety of a Herbal Toothpaste in Reducing Gingivitis: A Double-Blind, Randomized, Placebo-Controlled, Parallel Allocation Clinical Trial *Hindawi Evidence-Based Complementary and Alternative Medicine* Volume 2019
3. Chandrashekar Janakiram 1 , Ramanarayanan Venkitachalam 2 , Paul Fontelo 3 , Timothy J. Iafolla 4 and Bruce A. Dye 4*Effectiveness of herbal oral care products in reducing dental plaque & gingivitis –a systematic review and meta-analysis, Janakiram et al. *BMC Complementary Medicine and Therapies* (2020) 20:43
4. J Okpalugo, K Ibrahim, US Inyang, Toothpaste formulation efficacy in reducing oral flora, *Tropical Journal of Pharmaceutical Research*, February 2009; 8 (1): 71-77
5. K.L. Senthilkumar 1, S. Venkateswaran. 1 , A. Vasanthan 1 , P. Chiranjeevi 1 , N Mohamed 1, S. Dinesh 1 , K.L.S. Neshkumar. Formulation development and evaluation of novel herbal toothpaste from natural source *International Journal of Pharmaceutical Chemistry and Analysis* 2022;9(1):17–21
6. Pavan Deshmukh, Roshan Telrandhe, Mahendra Gunde, Formulation and Evaluation of Herbal Toothpaste: Compared With Marketed Preparation, Roshan T et al; *Int J. Pharm. Drug. Anal*, Vol: 5, Issue: 10, 2017; 406-410
7. E. N. Gaviraj , C. V. Nagathan , B. S. Hunasagi , Sandeep Chandakavate Preparation and Evaluation of Poly-Herbal Toothpaste Suresh Gunaki , *International Journal of Recent Advances in Multidisciplinary Topics*, VOL. 2, NO. 7, JULY 2021
8. Mahendran Sekar, Muhammad Zulhilmi Abdullah Formulation, Evaluation and Antimicrobial Properties of Polyherbal Toothpaste *Int J Curr Pharm Res*, Vol 8, Issue 3, 105-107
9. Urmila Nishad 1 , Meraj Ali 2 , Anupama Maurya 3, Formulation and Evaluation of a Polyherbal Toothpaste using Medicinal Plants; Urmila Nishad et al /*J. Pharm. Sci. & Res.* Vol. 12(1), 2020, 105-111
10. Kavita Varma Shukla, Deepika Kumari*Formulation Development and Evaluation of Herbal Toothpaste for Treatment of Oral Disease *Journal of Drug Delivery & Therapeutics.* 2019; 9(4-s):98-104

Research Through Innovation