

Research Article

Formulation and Evaluation of Herbal Toothpaste: Compared With Marketed Preparation

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Abstract

The aimed of current research to formulate herbal toothpaste utilizing plant extract like Neem leaves, Guava leaves, Cinnamon bark other ingredient are Camphor, Honey. The plant extract ingredient posses the anti-bacterial. The herbal toothpaste formulated which can satisfy all the required condition to keep the mouth fresh and prevent tooth decay by bacteria. The formulated herbal toothpaste compared with marketed preparation. Physical examination: Colour-greenish brown, smooth in nature, relative density-10.2, pH-8.2, Extrudability-90.37, spreadability- Good and stable formulation. The anti-microbial evaluation against Staphylococcus aureus reveal that formulated herbal tooth paste exhibited notable activity with ZOI of 19.7 mm at MIC of 25µg/mL. the outcome of this research herbal toothpaste shows equal patronizing and engrossing passion over the marketed preparation it was consider after the comparing the marketed preparation(Colgate, Dabour Red, Dant-kanti) with formulated herbal toothpaste. It has been good scope in future dental research and detail health of public.

Keywords: Herbal ingredient, toothpaste, anti-bacterial, dental, ZOI, Comparative study.

INTRODUCTION

The chemical agent that could supplant patient dependent mechanical plaque control and it reduce and prevent oral disease. Self performed mechanical plaque removal is one of most accepted method

of controlling plaque and gingivitis. The mechanical plaque control is time consuming and some are may lack motivation for these procedures¹. The therapeutic effect showing plants has been beneficial to the oral health from the thousands of year throughout the world. The traditional medicine has advantage more than the side effect like allergies. Neem is one of the most widely researched tropical trees for the development therapeutic action. 20 year ago the component of neem extract was analyzed².

The chewing sticks have been widely used in the Indian subcontinent, the Middle East and Africa since ancient time period. Dental caries is steadily increasing in the underdeveloped and developing country. Hence, there is an urgent need to promote traditional preventive measured that are acceptable, easily available and cost effective³.

The neem has been antibacterial activity is has evaluated from the ancient times. It has been use for the various activities like as astringent, antiseptic, insecticidal, anti ulcer and for cleaning the teeth in pyorrhea and other dental disease. The leaf extract of neem showed superior antiviral and antihyperglycemic activity *in vitro* and *in vivo* on animals. It showed good *in vitro* broad range antibacterial activity⁴. Nanotechnology may defined as the creation of material, drug and devices that are used to manipulate matter that in specific size and increase the drug targeting. While the using various herbal be use to be developed the nano-materials to enhances the action⁵.

It is an two group comparative study. Food debris are white small particles on teeth, can be easily rinsed off. The dental plaque is thin film of bacteria that sticks to teeth and yellow colour can't be rinsed off. There has been closer relationship between tartar, calculus and periodontal disease. The extract are use in various category like Neem-Antibacterial, Guava-Anti-inflammatory, Babul-Astringent, Kalmi-Flavoring agent and other ingredient are Camphor-Antisetic, Honey-Sweetening agent, Glycerine-Humectant, Cal Carbonate-Abrasive, SLS-Detergent and also use the sodium chloride and distilled water. This led to paing increased attention on using natural ingredients in herbal dentrifrices⁶.

The aim of study was to formulate herbal base product was compare the efficacy with conventionally marketed formulated toothpaste and evaluated the various parameter like colour, spreadability, foamability, extrudability and anti-bacterial activity. However, there is approach to provide the formulation for commercial production of herbal dental product with environmental friendly attributes.

MATERIALS AND METHODS

Chemicals

Calcium carbonate (Balaji Chemicals), Para hydroxyl benzoic acid (Loba Chemicals), Sodium lauryl sulfate (Loba Chemicals), Sodium chloride (Balaji Chemicals), Camphor (Local market), Honey (Local market) were purchased from market.

Collection

The following ingredient Neem, Gauva, Babul and Kalmi were collected from the plant present at medicinal garden campus of the Kamla Nehru College of Pharmacy situated in the Butibori area of Nagpur city in Maharashtra state of India. The plants were identified and authenticated by Dr. Dongarwar, Department of Botany, RTM Nagpur University, Nagpur, Maharashtra, India.

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 formed⁷. Table 1 and 2 shows plant extracts and composition of chemicals

Table 1: Plant extracts

Ingredient	Quantity(g)
Neem stem & bark	0.5
Babul leaves	0.5
Gauva leaves	0.5
Kalmi bark	0.5

EVALUATION OF FORMULATED HERBAL TOOTHPASTE⁸

According to the guidelines, the standards were

prescribed for each evaluation test of Type-I (non-fluorinated) OR Type-II (Fluorinated) toothpastes.

Physical Examination (Colour, odour, taste, smoothness, relative density)

Formulated toothpaste was evaluated for its colour. The visually colour was checked.

Odour was found by smelling the product.

Taste was checked manually by tasting the formulation.

The Smoothness was tested by rubbing the paste formulation between the fingers.

Relative density was determine by weight in gram taken in 10 ml formulation and 10 ml distilled water using RD bottle

Table 2: composition of chemicals

Ingredient	Quantity(g)
Camphor	0.5
Honey	0.5
Calcium carbonate	3.5
Glycerine	2.0
Para hydroxyl benzoic acid	0.3
Sodium lauryl sulfate	0.5
Sodium chloride	0.2
Distilled water	q. s.

Composition

All ingredients should be complied with the Indian standards. Toothpaste is not composed of mono or disaccharides such as sucrose or fermentable carbohydrates.

pH

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.

Homogeneity

The toothpaste shall extrude a homogenous mass from the collapsible tube or any suitable container by applying of normal force at 27±20C. in addition bulk of contents shall extrude from the crimp of container and then rolled it gradually.

Determination of sharp and edge abrasive particles

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 finger tip for the presence of sharp and hard edged abrasive particles. Toothpaste shall not contain such particles.

Foamability

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

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

Extrudability

In this method, the formulated paste were filled in standard capped collapsible aluminum tube and sealed by crimping to the end. The weights of tubes were recorded. The tubes were placed between two glass slides and were clamped. 500g was placed over the slides and then cap was removed. The amount of the extruded paste was collected and weighed. The percent of the extruded paste was calculated.

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:

$$S = \frac{M \times L}{T}$$

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.

Stability study

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°C ± 2°C / 60% ± 5% RH, 30°C ± 2°C / 65% ± 5% RH, 40°C ± 2°C / 75% ± 5% RH for the period of three months and studied for appearance, pH and spreadability.

Anti-bacterial activity

In-vitro anti-bacterial study of formulated paste was performed by disc diffusion method in triplicate manner by using Muller Hinton Agar medium against a pathogenic bacterial strain *Staphylococcus aureus* (*S. aureus*, MTCC 3160). *S. aureus* was initially cultured cells were tend to multiple in the Muller Hinton agar plates. Then the formulated paste containing discs were placed over the bacterial plates and incubated at 37°C for the 24 hour, comparing ciprofloxacin as the positive control. The diameter of zone of inhibition (ZOI) was measured in millimeters (mm).

The minimum inhibitory concentration (MIC) are the smallest concentration in which the compound displays no visible microbial growth. It had been determined by agar streak dilution method in triplicate manner. The protocol involves formulation of microbial suspension (~10⁵ CFU/mL), application to the petridish with serial dilution and incubation of petridish at 37±1°C. the MIC value was determined and average was taken.

Reading of plate and interpretation

After 15 to 16 hours of incubation, each plate was examined. If the plate satisfactory streaked, the inoculum were correct the result of ZOI should be uniformly circular and a confluent lawn of growth. After measure the diameter of ZOI the data was noted and interpreting the result.

Comparison: Formulated herbal toothpaste with marketed preparation¹⁰.

The formulated herbal toothpaste was compared with marketed preparation follows Anti-microbial activity, Spreadability, Foamability, pH determination, % Moisture content,

RESULTS AND DISCUSSION

The herbal tooth paste formulation was prepared from Neem leaves, Guava leaves, cinnamon bark, natural ingredient and small amount of synthetic ingredient. At the trial phase of formulation three batches were performed due to the problem like homogeneity, spreadability, and foamability the two batch discarded permentaly and only single batch was selected for next steps. The formulated herbal toothpaste greenish brown in colour and showed the good homogeneity with absence of lumps and good anti-microbial activity.

Physical Examination

Sr. No.	Parameters	Observations
1	Colour	Greenish brown
2	Odour	Characteristic
3	Taste	Characteristic
4	Smoothness	smooth
5	Relative density	10.2

Evaluation results

Sr. No.	Parameters	Observations
1	pH	8.2
2	Homogeneity	Good
3	Abrasiveness	Good abrasive
4	Foamability	10 (Good)
5	Moisture content	15.6%
6	Extrudability	90.37
7	Spreadability	3.5cm/sec (Good)
8	stability	stable

Extrudability

Extrudability	Mean of tree tube
Net wt of formulation in tube (g)	13.5
Wt of toothpaste extruded (g)	12.2
Extrudability amount percentage	90.37

Stability

At 25°C ± 2°C / 60% ± 5% RH (3rd month):

Colour	Appearance	Spredability	pH
Greenish brown	Homogeneous	3.5	8.2

At 30°C ± 2°C / 65% ± 5% RH (3rd month):

Colour	Appearance	Spredability	pH
Greenish brown	homogeneous	3.45	7.95

At 40°C ± 2°C / 75% ± 5% RH (3rd month):

Colour	Appearance	Spredability	pH
Greenish brown	Homogeneous	3.0	7.50

The stability study was indicated that the formulated tooth paste was good stability.

Anti-microbial activity

The formulated herbal toothpaste exhibited fairly good anti-*S. aureus* activity as compared to the standard drug ciprofloxacin. The formulation exhibited an impressive ZOI of 19.7 mm at MIC of 25µg/mL, whereas ciprofloxacin exhibited 24.5 mm ZOI at MIC of 6.25µg/mL. Therefore it may be concluded that formulated tooth paste have potential to exhibit anti-microbial activity.

Comparative study: Formulated herbal toothpaste with marketed preparation

Chart 1: Comparison between pH, Spredability & Foamability with marketed preparation

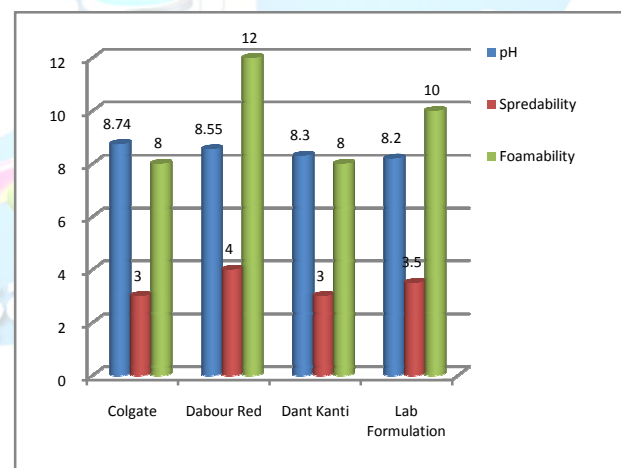
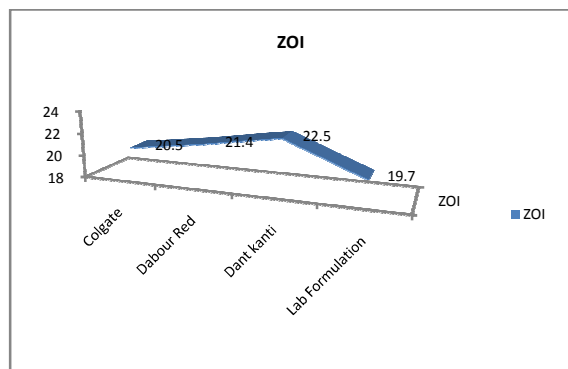


Chart 2: Comparison of anti-microbial activity with marketed formulation



% Moisture Content Comparison

Preparation	% Moisture content
Colgate	15.20%
Dabour Red	26.40%
Dant Kanti	8.80%
Lab Formulation	15.60%

The above chart 1,2 and Table shows that formulated herbal toothpaste is having equal or near about and engrossing passion over the marketed preparation (Colgate, Dabour Red and Dant kanti).

CONCLUSION

The research concluded that Herbal toothpaste an emphasizing and more acceptable in dental research and they are safer with minimum side effect than synthetic preparation. The formulated toothpaste capable to the tooth and oral hygiene and show the anti-microbial activity against pathogen. The formulation compared with market preparation. Therefore it shows the equal patronizing and engrossing passion over the marketed formulations (Colgate, Dabour Red, Dantakanti). The formulated herbal toothpaste has been good scope in future in nature remedies research and Dental health of public.

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