



Formulation and Evaluation of Anti-Bacterial Herbal Toothpaste: Compared with marketed preparation

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ABSTRACT :

The aimed of present research to formulate herbal toothpaste utilizing plant powders like, Neem Stem and bark, Guava leave, Babool Leaves, Cinnamon bark and other ingredient such as Camphor and Honey. Herbal toothpaste were prepared by using a different concentration of various ingredients. The herbal toothpaste formulated which can satisfy all the required condition to keep the mouth fresh and prevent tooth decay The prepared toothpaste was evaluated for different parameters like, spreadability, foaming power, stability, PH, moisture and and etc. All these tested parameters were compared with marketed preparation. (Dabur meswak, Dabur red, and Patanjali Dantkanti) with formulated herbal toothpaste. It has been a good scope in future dental research and detal health of public.

KEY WORDS:- Herbal toothpaste, anti-bacterial screening, dental cavity. Neem, Cinnamon Guava .

INTRODUCTION:

Popularity of herbal products is very much in all over world because people think that herbal products are safer than synthetic. They also believe in it's safety. Herbal toothpaste more effective than synthetic so they it help to reduce toothache, tooth decay and sensitivity. Herbal products use increased so we made this Antibacterial Herbal Toothpaste which help to maintain good hygiene and prevent periodontal disorder, reduce stains, gingivitis, calculus and tooth decay.⁽¹⁾

Cleaning teeth is first part of oral hygiene which is followed one generation to another and becomes daily morning routine. Different population use various techniques for teeth cleaning such as chewing sticks, use of finger to rub various substance on teeth like salt, charcoal, salt, oil etc. They not used proper tooth brush for cleaning teeth so they face many oral problems such as dental caries and periodontal disease. Dental carries commonly known as tooth decay which caused by streptococcus mutans. Periodontal disease also known as gum disease which is inflammatory condition of gum or the bone and tissue of teeth caused by S Mutans, bacterioides forsythus, staphylococcus intermediates, lactobacillus acidophilus, porphyromonas gingivalis,

pravotella nigrescens and treponema denticola.⁽²⁾

Toothpaste, also known as dentifrice, has evolved to prioritize the optimal release of active ingredients for both preventive and therapeutic oral care. Its primary functions include maintaining and enhancing oral hygiene, serving as an abrasive agent to remove food particles and dental plaque, and promoting overall oral health. Additionally, toothpaste helps to freshen breath and reduce halitosis, while its active ingredients like fluoride work to prevent dental and gum issues such as gingivitis. By maximizing the release of these active chemicals, toothpaste plays a crucial role in protecting and maintaining a healthy smile.⁽³⁾

Herbal toothpaste harnesses the potent properties of various herbs. Neem, for instance, exhibits antimicrobial properties, effective against *Streptococcus mutans*⁽⁴⁾. Babool leaves soothe mouth ulcers and provide pain relief⁽⁵⁾. Guava, rich in antioxidants, helps alleviate bleeding gums⁽⁶⁾. Cinnamon boasts antimicrobial, antioxidant, and anti-inflammatory effects⁽⁷⁾. Excipients play a crucial role in enhancing the cleaning process, complementing the mechanical action of toothbrushes for optimal oral hygiene. This study aims to evaluate the formulation of herbal toothpaste and compare its efficacy to three prominent commercial toothpaste products⁽³⁾. The investigation seeks to explore the potential of herbal ingredients in oral care, offering a natural alternative to traditional toothpaste. By assessing the effectiveness of herbal toothpaste, this research aims to provide valuable insights into the future of oral health products.

The widespread use of conventional toothpastes has led to concerns about adverse side effects, such as mucosal ulceration and circumoral dermatitis. In response, many individuals are turning to herbal toothpastes as a natural alternative. These products are perceived as safer since they don't contain synthetic ingredients. Herbal toothpastes owe their effectiveness to various properties, including anti-inflammatory, anti-microbial, astringent, anti-diabetic, anti-fungal, analgesic, and antiseptic properties. These natural ingredients work together to provide a comprehensive oral care solution. As consumers become increasingly health-conscious and eager to avoid harsh chemicals, the demand for herbal toothpastes is likely to grow, offering a promising alternative for those seeking a more natural approach to oral hygiene.⁽⁸⁾

The primary objective of this research was to formulate a herbal toothpaste containing natural ingredients traditionally used for oral care. The formulated toothpaste was evaluated for its organoleptic and physical properties, including color, odor, taste, pH, spreadability, moisture content, fineness, and foamability. These parameters were assessed in accordance with the standards set by the Bureau of Indian Standards and compared to commercially available toothpaste formulations. The results of the evaluation showed promising outcomes, with the lab-formulated herbal toothpaste demonstrating good quality compared to marketed formulations. This suggests that the natural ingredients used in the herbal toothpaste are effective in providing a suitable alternative to commercial toothpastes, offering a potential solution for those seeking a more natural approach to oral care.⁽⁹⁾

MATERIALS AND METHODS :

➤ DRUG PROFILE

1. Neem Stem & Bark⁽¹¹⁾ :-

➤ **Synonym :-** Margosa, holy tree.

➤ **Scientific name :-** *Azadirachta indica*.

➤ **Family :-** Meliaceae.

➤ **Biological Sources :-** Neem tree with the scientific name *Azadirachta indica* is “the Wonder Tree” and “nature's drug store”. Neem is among the highly exploited medicinal plant of Indian origin.

➤ **Chemical Constitutents :-** It contains Nimbin, a bitter compound that has been isolated from neem. Primary constituents include protein, fatty substances, or carbohydrate, secondary metabolites containing various alkaloids, steroids,



Fig.1

flavonoids, saponin etc.

➤ **Uses :-**

- It is used in traditional practices for treating inflammation and infections in dental disorder.
- It is used as anti-bacterial and anti-ulcer for mouth and gum.
- It prevent tooth decay and periodontal disease.



2. Babul Leaves ⁽⁵⁾ :-

➤ **Synonym** :- Gum Arabica , Gum acaci

➤ **Scientific name** :- *Vachella nilotic*

➤ **Family**:- Fabaceae



Fig.2

➤ **Biological Source**:- Acacia (Babool) is the second biggest genes in the leguminaceae family. It can be found in tropical and warm temperate region around the world with the highest no of species found in the Americas (185 species), Australia(957 species), Asia (89 species) and Africa (144 species).⁽⁵⁾

➤ **Chemical Constituents** :- It contain Calcium, magnesium, potassium, malic acid sugar.

➤ **Uses** :-

- Babul helps to relieve to joint pain.
- It is widely known to help relieve toothaches, bleeding gums make the gum stronger.
- Its anti-microbial property useful in mouth wash.
- Babul helps in fighting germs and making tooth strong.

3 Guava leaves :-

➤ **Synonym** :- Strawberry guava, true guava,⁽¹²⁾

➤ **Scientific name** :- *Psidium gujava*.⁽¹³⁾

➤ **Family** :- Myrtaceae family. ⁽¹²⁾



Fig.3

➤ **Biological source** :- Guava has been grown and utilized as an important plant in tropical areas like India, Indonesia, Pakistan, Bangladesh, and South America. Guava leaves are dark green electrical oval and characterized by their obtuse type apex.⁽¹⁴⁾

➤ **Chemical constituent** :- It contains Tannins, Vitamins, Phenolic compounds, Essential oils. The leaves of guava contain gallic acid, catechin.⁽⁶⁾

➤ **Uses⁽⁶⁾**:-

- It is used to prevent and control plaque.
- Guava shows anti-bacterial activity against the bacteria.

4 Cinnamon (kalmi bark)⁽¹⁵⁾ :-

➤ **Synonym** :- Cinnamon bark, Kalmi- dalchini,

➤ **Scientific name** :- *Cinnamomum verum*.

➤ **Family** :- Lauraceae.



Fig.4

➤ **Biological source** :- Cinnamon consist of dried inner bark mof shoots of coppiced tress of cinammomum zeylanicum.

➤ **Chemical constituents** :- It consist of 0.5 to 1 % of volatile oil, 1.2% of Tannins, mucilage, calcium oxalate, starch, and mannitol.

➤ **Uses :-**

- Used as carminative and mild astringent
- It is also used as flavouring agent, stimulant, aromatic and antiseptic.
- It is used as spice and condiment and also in preparation of candy and dentifrices.

REQUIREMENTS :➤ **CHEMICALS ⁽¹⁶⁾ :-**

Calcium carbonate, Methyl paraben, Sodium lauryl sulphate, Sodium chloride, Camphor, Honey.

Ingredient	Quantity(gm)
Neem stem and bark	0.5
Babul leaves	0.5
Guava leaves	0.5
Kalmi bark	0.5

table no1: herbal powders.

Excepients	Quantity(gm)
Camphor	0.5
Honey	0.5
Calcium carbonate	3.5
Glycerine	2.0
Methyl paraben	0.3
Sodium lauryl sulphate	0.5
Sodium chloride	0.2
Distilled Water	q.s

table no 2: composition of chemicals.

➤ **INSTRUMENTS AND GLASSWARES^(17,18) :-**

- **Instruments :-** PH meter , Hot air oven.
- **Glasswares :-** Beaker, Measuring cylinder, Petri dish, Glass slide, Stirrer, Mortar pestle.

EXPERIMENTAL WORK :(16,19,20)

All herbal ingredients were dried and grounded using domestic mixture



The required quantity of ingredient were weighed and taken in mortar.



Calcium carbonate, sodium lauryl sulphate, sodium chloride, honey, and glycerine were mixed in water.



Acacia were added into the above mixture.



Above solution was added drop wise into mortar containing herbal ingredients.



Triturated well until a taste consistency is formed.

All herbal ingredients were dried and grounded using domestic mixture. The required quantity of ingredient were weighed such as Neem (0.5gm), Guava (0.5gm), Babool (0.5gm), Kalmi bark (0.5gm) taken in mortar. Then calcium carbonate (3.5), Sodium lauryl sulphate (0.5gm), Glycerine (2gm), Sodium chloride (0.2gm), Honey (0.5gm), were mixed in water (qs). Acacia were added into above mixture. This solution was added drop wise into mortar containing herbal ingredients and triturated well until a paste consistency is formed.

COLLECTION :-

Fig.5

EVALUATION TESTS :

1. Physical Examination
2. pH determination
3. Spreadability
4. Foaming Index

5. Homogeneity
6. Moisture Content
7. Abrasiveness
8. Anti-bacterial test

1. Physical Examination ⁽¹⁸⁾

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. pH Determination ⁽²¹⁾

pH of formulated herbal toothpaste was determined by using pH meter. 10g toothpaste placed in 50ml of beaker. Allow the 10ml of boiled and then cooled water. Stir vigorously to make a suspension



Fig.6

3. Spreadability ⁽¹⁹⁾

In these method slip and drag characteristic of paste involved. Formulated paste (2g) placed on the ground slide under study. The formulated paste placed like sandwich between these slide and another glass slide for 5min to expel air and provide a uniform film of the paste between slides Excess of the paste was scraped off from the edged. The top plate was then subjected to pull of 80g with 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 inter vak indicated better spreadability.

Formula was use to calculate spreadability: $S = M \times L/T$

Where,

S = Spreadability

M = Weight in the pan (tiede to the upper slide) L=Length moved by the glass slide

T=Time (sec) taken to separate the upper slide the from the ground slide.



Fig.7

4. Foaming Index ^(2,19)

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.

Foaming power = $v_1 - v_2$

V_1 = volume in ml of foam with water. V_2 = volume in ml of water only.



Fig.8

5. Homogeneity ⁽²⁰⁾

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

6. Determination of moisture content ⁽¹⁷⁾

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

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



Fig.9

7. Abrasiveness^(19,3)

x 100

Toothpaste abrasivity of the toothpaste is the most important parameter that affects the abrasion process of dental hard tissue. Toothpaste abrasivity is dependent on several parameters including the type of abrasive (chemical composition), concentration, particle size, size distribution, surface structure of the abrasive particles, diluents, and the dilution rate of toothpaste. There is a linear relation between abrasive wear and size and the concentration of abrasive particles, as particle size and concentration increase, abrasive wear increased well.(20)

Extrude the content 15 to 20 cm long on the butter paper. Press with the content of the entire length with finge tip for the presence of sharp and hard edge abrasive particles. Tooth paste shall not contain such particl



Fig.10

7. Anti-bacterial Activity⁽³⁾

The toothpastes were diluted in sterile water to concentration of 100 mg/ml, 50 mg/ml and 25 mg/ml. Anti-microbial activity of toothpaste with different formulation was asses against *S.mutans* using modified agar well diffusion technique. A standardized inoculums matched with McFarland 0.5. turbidity standard of the isolate was inoculated on to a Mueller hinton agar plate with a sterile cotton swab stick. The plaers were bride for 15 min. Using a sterile for borer of 10ml in diameter, wells were bored into the inoculated agar plates and the different concentration of the toothpaste were added to the well, in a volume of 0.2 ml. Sterile distilled water was added into separate well as a control. The plates were left for 40 min. For prediffusion and then incubated at 37°C for 24 hours. Zones of inhibition were measured in millimeters.

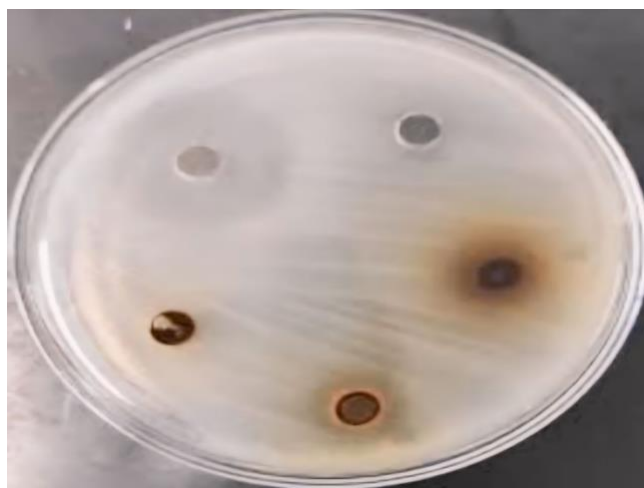


Fig.11

RESULT AND DISCUSSION:-

The formulated herbal toothpaste was evaluated visually for its colour that is yellowish brown. Odour was found by smelling the product i.e Aromatic and test was checked manually by testing the formulation. We found that all toothpastes were having good consistency and smooth texture. The pH of formulated herbal toothpaste was found to be 7.19. The foamability of herbal toothpaste was found to be 1.5cm. LOD of formulated herbal toothpaste was found to be minimum than other marketed herbal formulation and it is found to be 3.22 % . The activity increases in terms of abrasiveness and spreadability. Anti-bacterial test of formulated herbal toothpaste were compared with marketed herbal toothpaste and it was observed that, formulated herbal toothpaste has good anti-bacterial activity and same efficacious with that of marketed one.

The sensory evaluation parameters of herbal toothpaste is evaluated by observing colour, odour, taste (Table No.3)

Sr.no	Parameter	Observation
1.	Colour	Yellowish Brown
2.	Odour	Aromatic
3.	Taste	Spicy Sweet
4.	Consistency	Good consistency

table no 3: physical evaluation parameters (colour, odour, taste)

Formulated herbal toothpaste test were carried out to compare different properties of formulated herbal and marketed toothpastes The color of the formulated product is observed yellowish brown by checking visually. Then the odour was found by smelling the product that is aromatic and taste was checked manually by testing the formulation that is spicy sweet. We found that toothpaste having good consistency.

The consistency smoothness, and abrasiveness is evaluated and described in below (Table No.4).

Sr.no	Parameter	Observation
1.	Smoothness	Smooth
2..	Abrasiveness	Good Abrasive

table no 4 : sensory evaluation parameter (consistency, smoothness, abrasiveness)

We found formulated toothpaste having smooth texture by rubbing the toothpaste in between the fingers and also we found that there is no abrasive particles in formulated toothpaste. That is good consistency.

The evaluation test of Ph, Foamability, moisture content, spreadability, homogeneity, stability, is observed and described in below (Table No.5)

Sr.no	Parameter	Observation
1.	pH	7.19
2.	Foaming index	1.5 cm
3.	Moisture content	3.22 %
4.	Spreadability	0.31 cm/sec
5.	Homogeneity	Good
6.	Anti-bacterial test	5 ± 7 mm

table no 5 : physiochemical evaluation parameter (ph, foamability, moisture content, spreadability, homogeneity, anti-bacterial test)

As a performed physiochemical evaluation parameters the pH of formulated herbal toothpaste was found to be 7.19 it is good pH of herbal formulation because normal range of Ph of herbal toothpaste is 7 to 9. We found that foaming index of formulated herbal toothpaste was 1.5 cm which create good foam to cleaning teeth. LOD of formulated herbal toothpaste was found to be maximum and its 3.22 % .The activity increases or good in term of spreadability and homogeneity. Anti-bacterial test of formulated herbal toothpaste performed and it was observed formulated herbal toothpaste has good anti-bacterial activity (25.8 ± 1.4 mm) and it is effectiveness is good

COMPARATIVE STUDY :-

Formulated herbal toothpaste with marketed formulation. (Dantkanti, Dabur Red, Meswak)

The formulated toothpaste was compared with the marketed preparation for its colour, odour, taste, consistency, smoothness, abrasiveness, moisture content, foaming test, stability, pH, determination, spreadability, homogeneity and Anti-bacterial activity.

The physical examination of the formulation of herbal toothpaste is compared with marketed formulation and is described in the below (Table 4), (Table 5).

Sr.no	Parameters	Formulation	Dantkanti	Dabur Red	Meswak
1.	Colour	Yellowish Brown	Yellowish Brown	Orange Red	White
2.	Odour	Aromatic	Aromatic	Pleasant	Pleasant
3.	Taste	Spicy Sweet	Mint Spicy	Spicy	Mildly Bitter
4.	Consistency	Good	Good	Good	Good

table no 6 : physical examination of formulation with marketed formulation.

Sr.no	Parameters	Formulation	Dantkanti	Dabur Red	Meswak
1	Abrasiveness	Good Abrasive	Good	Good	Good
2.	Homogeneity	Good	Good	Good	Good
4.	Smoothness	Smooth	Smooth	Smooth	Smooth

table no 7 : sensory examination of formulation with marketed formulation.

The physiochemical evaluation of the formulation of herbal toothpaste is compared with marketed formulation and is described in the below (Table 6).

Sr.no	Parameters	Formulation	Dantkanti	Dabur Red	Meswak
1.	Foaming index	1.5 cm	0.5 cm	1 cm	1.3 cm
2.	Moisture Content	3.22 %	2.91 %	1.99 %	3.77 %
3.	Spread ability	0.31 cm/sec	0.33 cm/sec	0.31 cm/sec	0.36 cm/sec
5.	pH	7.19	8.23	8.73	8.85
6.	Antibacterial test (mm)	5 ± 7	5 ± 6	4.2 ± 5	5 ± 5.2

table no 8 : physiochemical evaluation of parameters.

CONCLUSION :-

Conclusion can be drawn from the results obtained in the present work of investigation this herbal toothpaste it is having prominent function in the maintaining the oral hygiene and preventing dental caries and are safer with minimum side effect than chemical based synthetic toothpaste. Formulated toothpaste is capable to maintain the tooth and oral hygiene and show anti-bacterial activity against the bacteria. Herbal toothpaste was found to be similarly effective as commercially available toothpastes in terms of all toothpastes evaluation parameter, by expanding natural ingredient for making more and safer natural medicines, the design herbal toothpaste has a bright future in research and dental care for the public society and nation. It was determined that the developed herbal toothpaste was of good grade than marketed herbal toothpaste.

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