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Preparation and Evaluation of Herbal Toothpaste

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Abstract: *The majority of people use toothpaste regularly.Typically, tootpaste is used to clean the mouth and teeth. It is also used to treat a variety of dental conditions. A lot of dentists advise using toothpaste to cure conditions including sensitivity and chronic gingivitis, among others. Herbal extracts of numerous crude medications with antibacterial and antimicrobial properties can be used to make herbal toothpaste. Herbs like ginger, indica extracts, babul leaves extract, ginger extract, lemon oil extract, neem stem & bark, babul leaves, gauva leaves, kalmi bark, etc. are used in the preparation of herbal toothpaste formulations. [1] Preparing, assessing, and contrasting lab-made herbal toothpaste with commercial herbal toothpastes is the major goal of the current effort. Commercial herbal toothpastes including Himalaya, Meswak, and Dent County have all had their quality assessed in the current study. All of the examined commercially available herbal tooth pastes and lab-made herbal toothpaste met the requirements outlined by the Bureau of Indian Standards. [2] The goal of the ongoing research is to create herbal toothpaste using chemicals like camphor, honey, and plant extracts including neem, tulshi leaves, and guava leaves. In formulating herbal toothpaste, characteristics like colour, spreadability, foamability, and particle identification of shard and edge abrasives were assessed. [3] Neem, Clove, Betel, Peppermint, Turmeric, and Guava are six plant samples included in this experiment that are typically used as traditional medicines. The created toothpastes were assessed in accordance with Bureau of Indian Standards requirements. The effectiveness of the tested toothpastes' antibacterial properties was found. [4] One of the most important needs for humans is oral hygiene. Oral hygiene is the first step in a human being's daily life. Therefore, toothpaste is crucial to this process. To counteract some drawbacks of synthetic cleaning agents, many natural herbs might be used. [5].*

Keywords: Herbal toothpaste, Ginger, Neem, Kalmi Bark, Guava Leaves

I. INTRODUCTION

Since ancient times, toothpastes have been used1 and are a vital, indispensable part of oral healthcare. From 300 to 500 BC, formulas for toothpaste were developed in China and India. A dentifrice called toothpaste is used to clean, preserve, and enhance the health of teeth. The primary purpose of toothpaste is to encourage oral hygiene. [6]

The term "herbal medicine" refers to the use of any plant material for therapeutic and disease-treating purposes. Herbal remedies have been used extensively throughout human history, and the World Health Organization (WHO) estimates that around 80% of people used herbal remedies as their primary form of healthcare1. Additionally, it has been shown that over 35,000 plant species are employed for medicinal purposes in numerous human societies around the globe2. Some of them have strong antibacterial, antiviral, anticancer, and antifungal properties. [7]

The most popular preventive method for oral health care Is toothpastes. Many dentifrices sold commercially make claims about having antibacterial characteristics, although little study has been done to verify these claims. As a result, this study was carried out to assess the effectiveness of various toothpaste formulations in lowering the oral microbial burden. The formulas of the chosen tooth pastes were successful in reducing the microbial load, which helped to maintain good oral hygiene. The efficiency of the various chemicals in the toothpastes used, however, is less important for maintaining excellent oral health than using the proper oral hygiene practises and brushing technique.

One of the most prevalent oral conditions with a significant incidence worldwide is chronic gingivitis. The primary cause and initiating factor for the onset of gingivitis is dental plaque. However, due to the limitations of mechanical approaches, it is also thought to be a suitable supplement to the control of mechanical plaque to add some safe and effective medications to prevent gingivitis to toothpaste. According to studies, toothpaste additives like triclosan and chlorhexidine directly prevent plaque from forming on teeth. [3]

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The major purposes of semisolid toothpaste formulations are oral cavity cleaning and oral hygiene maintenance. Today, toothpaste is seen as a basic human need because cleaning the mouth before bedtime prepares one for the day. Many commercially available toothpaste formulations are made with synthetic excipients, however some formulations are made with herbal extracts.

Some of the chemical ingredients that have been added to toothpastes and mouthwashes have been demonstrated to lessen the development of dental plaque. The use of "herbal" medicine has generated interest and aided in the establishment of complementary and alternative therapies in the field of health care promotion as a result of a greater understanding of indigenous medicinal traditions in many regions of the world.

Reduced oral bacterial flora and fluoride delivery are toothpaste's primary goals. This is because fluoride, which is naturally present in many commonplace items including food and water, has been shown to protect teeth against bacterial attack. To promote dental health, toothpaste that effectively decreases oral bacterial flora should be used. Typically, triclosan is found in gum. Because of its antibacterial qualities, it is a component used to prevent gum disease. It is also known that sodium fluoride, the active component, has antimicrobial effects. Natural toothpastes are ones that don't contain fluoride or triclosan. They typically include natural compounds like lemon, eucalyptus, rosemary, chamomile, sage, and myrrh extracts as well as particular mineral salts like sodium fluoride and sodium chloride.

With the aid of excipients found in toothpaste, the mechanical action of the toothbrush performs the majority of the cleaning. 6–8 Because they contain active chemical ingredients like polyphenols, gums, alkaloids, glycosides, and other substances, many herbal formulations are particularly effective. These formulations have also been investigated for various biological activities. [8]

With the use of a toothbrush, toothpaste is a substance with a gel or paste formulation that is used to clean and maintain oral hygiene. The community frequently uses this product for dental care. Even while brushing your teeth twice a day is advised by the majority of dentists and is quite effective at removing plaque, it cannot prevent bacterial illness. Plaque removal reduces the likelihood of periodontal inflammation, which is mostly brought on by bacteria or oral flora. It is advised that the patient use toothpaste with more antibacterial activity to solve this issue. [9]

Benefits of Herbal Toothpaste

Your mouth's bacteria can lead to gingivitis and other dental problems. Natural toothpastes can remove oral bacteria without the use of dangerous chemicals. To freshen your breath, natural toothpastes employ natural components like mint and other herbs.

Objective of Herbal Toothpaste

1. The plant extract ingredient has antibacterial properties.
2. The formulation of a herbal toothpaste that can satiate every prerequisite for maintaining oral hygiene and preventing bacterial tooth decay

Ideal Properties of Toothpaste

1. Strong abrasive action
2. Non-toxic and non-irritating
3. Leave no stains on the teeth.
4. Maintain a healthy and clean mouth
5. Long-lasting impact
6. Accessible and affordable
7. It shouldn't hurt the oral fluid and tissue.
8. It shouldn't discolour teeth.
9. It should taste good and have a pleasant aroma.
10. Should not have any drug resistance that was induced.

Advantages of Herbal Toothpaste

1. Simple to use

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2. The ADA has approved numerous products.
3. Fluoride may be present to prevent cavities.
4. No one wants their body to be filled with chemicals, and even toothpaste sold in stores contains these harmful substances. To prevent tooth decay, we must use the natural alternatives that are already available. Herbal toothpastes provide a lot of benefits.
5. Sodium laurel sulphate, a component of commercial tooth paste, can irritate and inflame the gums while brushing. But there are no chemical ingredients in herbal toothpaste.
6. Natural oral care products work well to get rid of bacteria and maintain a healthy mouth.
7. Herbal toothpaste contains peppermint and spearmint oils, which aid in killing bacteria.

Disadvantages of Herbal Toothpaste

1. Organically certified herbal toothpaste is the safest option; otherwise, our teeth could potentially be endangered.
2. It shouldn't include cinnamon or any synthetic chemicals or dyes.
3. May originate from producers who aren't honest about their business operations or who don't adequately label substances, including fluoride, which some people find concerning.
4. Long-term use of excessive amounts of fluoridated toothpaste can cause fluorosis. If toothpaste is ingested in any amount continuously, it can be acutely poisonous.
5. of toothpaste has been found to be the real culprit in the development of some conditions, including tooth sensitivity and enamel thinning.
6. Chloroform, a human carcinogen, is created when the active ingredient in many toothpastes, triclosan, combines with the chlorine in tap water.
7. According to some scientists, it can cause brain damage to unborn children.

FORMULATION -1

The ingredients for the herbal toothpaste were all dried and ground in a kitchen mixer. The necessary number of components were measured out and put into a mortar. Water was combined with calcium carbonate, sodium lauryl sulphate, methyl cellulose, honey, and glycerin. The mixture above included acacia. Drop by drop, this solution was put to a mortar together with herbal components, and it was thoroughly triturated to make a paste.

Composition

Sr. No	Ingredients	Quantity
1	Neem stem and bark	0.5
2	Babul leaves	0.5
3	Guava leaves	0.5
4	Kalmi bark	0.5
5	Camphor	0.5
6	Honey	0.5
7	Calcium carbonate	3.5
8	Glycerin	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

Procedure-

I first visited a botanical garden before gathering some neem and guava leaves. I then used a grinder to crush the neem and guava leaves. I then proceeded to the pharmaceutics lab to gather all the substances I required. Using a weighing machine, weigh each ingredient. All of the ingredients were then added to the mortar, with the exception of methyl paraben, which was added last because it serves as a preservative. Then, using a piston, combine all the ingredients. The

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compound was then given a sufficient amount of distilled water. With the aid of a piston, thoroughly combine, and then transfer the mixture into a toothpaste container with clear labelling.

II. EVALUATION OF TOOTHPASTE

Physical Exam

- The colour of toothpaste with a colour formulation was assessed.
- The colour was examined visually.
- Odor—Smelling the substance revealed an odour.
- Taste: The formulation was manually tasted to assess the flavour.

Relative density

Weight in grammes was measured using an RD bottle with 10 ml of formulation and 10 ml of distilled water. Evaluation criterion.

Abrasiveness

Extrude the material onto the butter paper until it is 15 to 20 cm long. Repeat the process to create at least ten collapsible tubes. Fingertip pressure along the length of the object should reveal any sharp or hard-edged abrasive particles. Such particles are not permitted in toothpaste.

Calculating Spreadability

This technique uses the paste's slip and drag properties. (2g) of prepared paste was applied to the ground slide. In research To remove air and create a homogenous paste film between slides, the prepared paste was sandwiched between this glass slide and another for five minutes. The edges of the paste were scraped clean of excess. The top plate was then pulled 80g with the aid of a line tied to a hook, and the amount of time (in sec) needed for the top slide to travel 7.5cm was recorded. Better Spreadability was indicated by a brief interval.
Spreadability was determined using the following formula:
Where S=Spreadability, M=M-L-T
Weight in the pan is M. (tied to the upper slide)
L = The length that the glass slide moved.
T is the amount of time (in seconds) needed to separate the top slide from the bottom slide.

pH Calculation

Using a pH metre, the pH of a herbal toothpaste formulation was determined. 150ml of beaker were filled with 10g of toothpaste. Allow 10 cc of water that has been heated and then cooled. In order to create a suspension, stir briskly.

Homogeneity

By applying normal force at 27°C, the toothpaste must extrude a homogenous mass from the collapsible tube or any other suitable container. Additionally, the bulk of the contents must protrude from the container's crimp before being gradually rolled.

Foaming

By mixing a tiny amount of the formulation with water, the foamability of toothpaste formulations is assessed. Initial cylinder capacity measurement was recorded, followed by a 10-time shake. Foam's final volume was noted. Calculating froth power
Power of foaming = V1 – V2
V1: Water and foam volume in millilitres. Only in ml of water,
V2 is the volume.

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Stability

The stability study was conducted in accordance with ICH guidelines. The prepared paste was placed within a collapsible tube and stored for three months at various temperatures and humidity levels, including 25°C, 2°C, and 60%, 65%, and 5%, respectively. Moreover, spreadability, pH, and appearance were examined.

Moisture and volatile matter determination

A porcelain dish about 6 to 8 cm in diameter and 2-4 cm deep was filled with 5 g of the formulation. Dry the Sample in a 105°C oven.

Calculation

Mass = 100Mi/M by M-Mass (g) of the material used for the test MI-Loss of mass (g) on drying 9

Content of moisture

Weighted toothpaste (10 gm) was placed in a porcelain plate and dried at 105 o C in the oven. It was desiccated to chill it.

The supplied formula is used to compute the weight loss and record it as a percentage of moisture content.

Dry sample weight divided by the original sample weight gives the percentage of moisture.

Character that foams

In a test tube with a stopper (height 16 cm, diameter 6 mm), 1 g of tooth paste was added. The liquid's volume was then increased by 10 ml with water. The tube was stopped and shaken for the desired length of time at a rate of two shakes per second. 15 minutes of standing time was given, and the height of the foam created was measured.

A 10% tooth paste solution was made. 146 ml of water were mixed with 4 ml of this solution at 30 o C. For ten seconds, the Solution was agitated. A 100 ml graduated cylinder was filled to the brim with foam. The foam was gently filled with a rubber stopper. It took between 40 and 80 milliseconds for the rubber stopper to move between the two spots. The foam is denser and more stable when it falls for a longer period of time

Organoleptic assessment

By using sensory and visual inspection, organoleptic evaluation (colour, taste) was carried out.

pH

One gramme of the product was dissolved in nine millilitres of water, shaken vigorously, and the pH of the resulting aqueous solution was measured using a pH metre.

Smell test

It was evaluated for acceptability based on personal observation.

It was decided whether the aroma was acceptable after asking five persons for their opinions. The following criteria were used to evaluate fragrance:

A) The scent was commensurate with that of a toothpaste of reference.

B) The aroma wasn't great, but it was equivalent to the toothpaste used as a reference.

C) The toothpaste's aroma was inferior to that of the standard toothpaste.

Formula 2:

Materials and Procedures: Chemicals and Reagents

Lobo Chemise is where the excipients sodium Lauryl sulphate, glycerine, and calcium carbonate are acquired (Mumbai). Sodium chloride and tragacanth gum are purchased from SD Fine Chemical Ltd. (Mumbai). Hi-Media laboratories sell sorbitol, propylparaben, and carboxy methyl cellulose (Mumbai). The chemicals employed are all of the analytical variety.

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Herbal Extracts:

Table 1[8–12] shows the herbs employed in the formulations of the present and their typical roles in toothpaste. The herbs used to create multi-herbal toothpaste formulations are shown in Figs. 1 to 5. [5]

Table 1: Information on Herbs used in toothpaste

HERBS	SCIENTIFIC NAME	EFFECT
Neem	Azadirachta Indica	Anti-inflammatory Antibacterial Anti hemorrhagic effect
Clove	Eugenia caryohyllus	Analgesic Anti-cancer effect
Pippermint	Mentha piperita	Antiviral Antispasmodic effect
Betel	Piper betle	Anti ulcer Anti diabetic effect
Turmeric	Curcuma longa linn	Antioxidant Antimutagenic Antimicrobial Antibacterial Antifungal effect

Fig. 1 The leaves of Neem

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Fig.2 The dried Clove buds

Herb collection:

Neem leaves are gathered from the B.V.V.S campus and dried for two days at 40° C in a hot air oven. The dried leaves were then gathered and ground into a fine powder using a mortar and pestle.After being properly cleansed, clove, peppermint, and betel are acquired from the grocery store. All herbal medications are then dried and ground into a fine powder using a mortar and pestle Obtained. The supermarket store sells pure and fresh turmeric powder. Then, all of the powdered herbs are set aside for later use.

Fig.3 The fresh Pippermint leaves

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Fig. 4 The Betel Leaves

III. TOOTHPASTE PREPARATION PROCESS

Trituration Procedure:

The multi-herbal toothpaste was made using all of the obtained herbal extracts (powders). A computerised weighing balance was used to weigh the ingredients precisely (FB 600 Essae, Teroka). Then, in increasing order of their percentage, the weighed herbal powders of Neem, Clove, Turmeric, Peppermint, and Betel were added to the mortar. Afterward, properly triturated with a pestle. After that, calcium carbonate, sorbitol, and sodium lauryl sulphate are added and

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thoroughly combined. Carboxymethyl cellulose, tragacanth gum, and more glycerine are combined thoroughly. Sodium chloride and propylparaben are then added to the previously mentioned combination. Then, demineralized water is added to the powder mixture to make it into a paste, and the trituration continues until a thick paste is produced [14]. Table 2 includes information on the ingredient quantities.

Table 2. Toothpaste Formulation Chart.

Excipients	Quantity - F1	Quantity- F2	Quantity -F3
Neem extract	1	1.5	1
Clove	0.5	1	1
Pippermint	1.5	1	1
Betel	1	0.5	1
Turmeric	1	1	1
Calcium Carbonate	12.5	12.5	12.5
Glycerine	2.5	2.5	2.5
Sodium lauryl sulfate	0.5	0.5	0.5
Tragacanth gum	0.25	0.25	0.25
Sodium chloride	0.25	0.25	0.25
Sorbitol	0.25	0.25	0.25
Propylparaben	0.5	0.5	0.5
Carboxy methylcellulose	0.25	0.25	0.25
Distilled water	10-20	10-20	10-20

IV. HERBAL TOOTHPASTE EVALUATION

1. Physical inspection:

Color, taste, and odour of the produced multi-herbal toothpaste formulations were tested for organoleptic parameters, and the results were published [15].

2. pH measurement:

A pH paper was used to ascertain the formulation's pH. One drop of the diluted paste was poured on pH paper, and the colour change was compared with the standard colour strip. One gramme of prepared herbal toothpaste was diluted with 100 ml of distilled water. The formulation's pH is then recorded [16].

3. Viscosity:

Using a Brookfield viscometer (LVDVE Brookfield Engineering Labs, USA), the viscosity of each toothpaste formulation was measured (see Fig. 6). First, the created toothpaste formulation was stored in a narrow mouth container, and the spindle of the Brookfield viscometer was submerged inside of it for two minutes. Using a Brookfield viscometer with a number 64 spindle and 100 rotations per minute, the viscosity of all the manufactured Multi herbal toothpaste was measured. To determine the average viscosity of the formulations, dial readings were collected three times. Results were also made public [17].

4. Extrudability:

Five grammes of each of the created multi-herbal toothpaste formulations were carefully measured, placed into capped aluminium collapsible tubes, and their open ends were sealed with clinching equipment.

V. MACHINE FOR SEALING ALUMINUM TUBE -

It is noted the initial weight. The extruded paste was once more weighed after the formulation of filled aluminium tubes was checked for the application of light pressure. The formula was used to calculate the percentage of extrudability, and the results were compared to benchmark values [18,19].

$E = [(W2/W1)] \times 100$ ….(1) (1)

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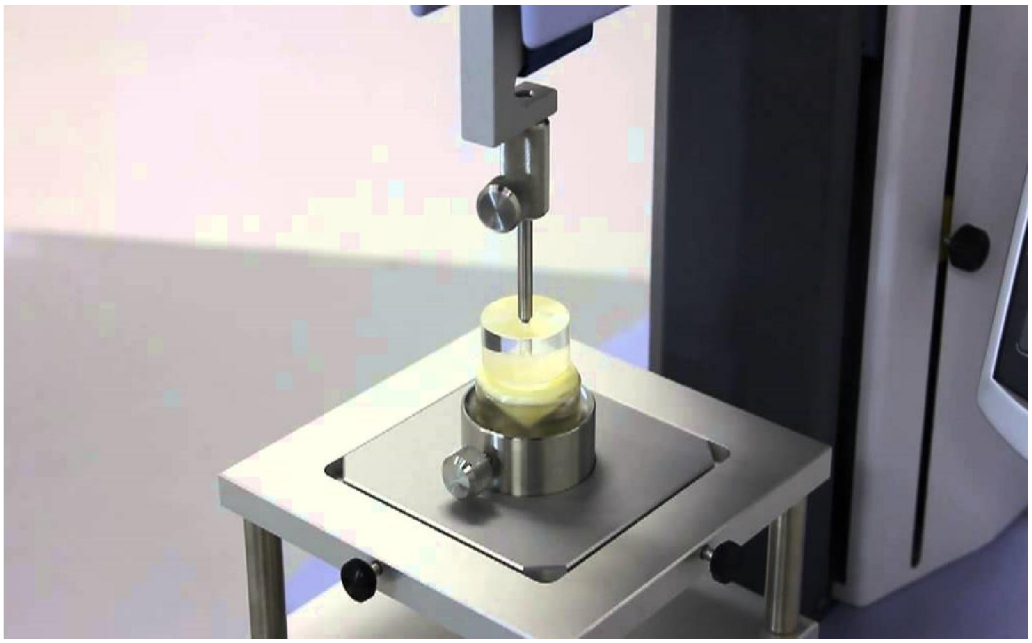
Where W1 = weight of gel extracted (g), W2 = weight of gel extruded out of tubes, and E =% Extrudability (g). The optimal way the formulation can be extruded out was determined by comparing percentage extrudability to these standards. 90% of respondents rated it as Excellent, 80% as Good, and 70% as Fair.

5. Determination of Spreadability:

One gramme of toothpaste was placed on a glass slide, which was then covered by a second slide the same length. The assembly used to do this is depicted in Fig. 8.



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SPREADABILITY TEST

6. Foamability

To test the foaming capacity of the herbal toothpaste, 2 g of toothpaste and 5 ml of water were combined in a measuring cylinder. The initial volume was noted, and the cylinder was then shaken ten times. The procedure was carried out three times in order to obtain average values. The final volume of the toothpaste with foam in the measuring cylinder was noted down.

7. Determining Abrasiveness:

The abrasive agents employed in toothpaste formulations have a significant impact on how abrasive it is. Commonly used abrasives in toothpaste formulas include calcium carbonate, tricalcium phosphate, and dicalcium phosphates. To check for any abrasive particles in the formulations, the content is scraped across a 15–20 cm length. The outcomes were recorded for each formulation.

8. Homogeneity

When applying normal force to a transparent collapsible tube of toothpaste at 27°C, a homogeneous mass should be extruded. Bulk contents must also protrude from the container's crimp before rolling it progressively. The finding was reported.

VI. CONCLUSION

Herbal toothpastes play a significant part in preserving oral hygiene and avoiding dental lcavities. The polyherbal toothpaste formulation was successfully tested utilising a variety of industry-standard criteria, including its antimicrobial characteristics. Promising antimicrobial activities were seen against both species by the extract. In comparison to totally synthetic toothpaste, the designed toothpaste might be safer. To demonstrate the safety and effectiveness of the toothpaste formulation, more research is required.

The Bureau of Indian Norms Standards were evaluated and compared to all herbal toothpaste sold commercially as well as versions created in laboratories. Specially formulated toothpaste has antibacterial activity against microorganisms like E. coli and is capable of maintaining oral and dental hygiene.

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A promising future in dental research and treatment for the general population, society, and country. The created herbal toothpaste was found to be of high quality.

The trituration process was used to create a multi-herbal toothpaste that contained neem, peppermint, clove, turmeric, and betel. The three formulations—coded F1, F2, and F3—were created and put up against commercially available goods. The viscosity, spreadability, foamability, extrudability, homogeneity, and abrasiveness qualities of all three formulations were good. Comparing these three formulations to the commercially available Meswak, Patanjali, and Babool products yielded positive evaluation findings for all three.

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