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FORMULATION AND EVALUATION OF HERBAL TOOTHPASTE: A NATURAL APPROACH TO ORAL HEALTH

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ABSTRACT

An herbal toothpaste was formulated using neem, guava, cinnamon, camphor, and honey for their antibacterial properties. The toothpaste exhibited a smooth texture, greenish-brown color, pH 8.2, and good stability. Antimicrobial testing against *Staphylococcus aureus* showed a 19.7 mm inhibition zone, indicating strong activity. This formulation holds promise for dental health and future research.

KEYWORDS: Herbal ingredient, toothpaste, anti-ulcer, antibacterial, dental, Comparative study.

INTRODUCTION

India's growing population increases healthcare demands, especially in rural areas where 75% of people reside. Chemical denture cleansers prevent dental issues but have side effects and are costly. Herbal alternatives are safer and more affordable. Candida albicans presence is higher in patients with dental prostheses. Chlorhexidine gluconate is a widely used antimicrobial but has side effects.

Traditional herbal remedies like triphala, clove, cashew leaves, meswak, aloe vera, and guava leaves offer oral hygiene benefits. Triphala and cashew leaves combat Candida albicans, while aloe vera has antifungal, antiviral, and antibacterial properties. Essential oils also show antimicrobial potential. Neem, known for its antibacterial and antiseptic properties, has been traditionally used for dental diseases like pyorrhea.

Chewing sticks have been used for centuries in India, the Middle East, and Africa. With rising dental caries in developing nations, promoting cost-effective, traditional preventive measures is crucial. Neem has long been

recognized for its antibacterial properties and oral health benefits.

Nanotechnology enhances drug targeting by developing nano-materials from herbal ingredients. This study compares herbal dentifrices with conventional toothpaste, assessing parameters like color, spreadability, foamability, extrudability, and antibacterial efficacy. Food debris can be rinsed off, whereas dental plaque requires active removal. Herbal extracts serve multiple roles: Neem (antibacterial), Guava (anti-inflammatory), Babul (astringent), and Kalmi (flavoring). Additional ingredients include camphor (antiseptic), honey (sweetener), glycerine (humectant), calcium carbonate (abrasive), SLS (detergent), sodium chloride, and distilled water.

Emphasizing natural ingredients in herbal dentifrices highlights their advantages over conventional formulations, providing effective, affordable, and safer oral hygiene solutions.

Advantages of Toothpaste

1. **Active Ingredients**: Helps prevent tooth and gum disease with fluoride or xylitol.
2. **Advancements**: Includes options like kid-friendly, desensitizing, and whitening toothpaste.
3. **Convenient**: Easy-to-use, collapsible tubes.
4. **Multi-purpose**: Combines ingredients to address various oral health needs.

Dental Oral Diseases

Poor oral hygiene can lead to caries, gum disease, and increase the risk of heart disease, cancer, and diabetes. Consistent care—brushing, flossing, and limiting sugar—helps prevent costly procedures and long-term health issues.

SYMPTOMS OF DENTAL AND ORAL PROBLEMS

1) Ulcers sores, or tender areas in mouth
2) Bleeding or swollen gums
3) Chronic bad breath
4) Sensitivity
5) Loose teeth
6) Gums
7) Pain or toothache
8) Pain with chewing or biting
9) Swelling of face and Cheek
10) Cracked or broken teeth.

Types of Dental Diseases

1. Cavities

Also known as tooth decay, cavities are caused by bacteria, sugary drinks, and plaque. Untreated, they lead to toothache, tooth loss, and infections.

2. Gum Disease (Gingivitis)

Gingivitis is an infection that causes gum inflammation and bleeding. Caused by poor oral hygiene, it can lead to more severe oral issues if untreated.

3. Periodontitis

This advanced gum disease can damage the jawbone and lead to tooth loss. It increases the risk of heart and lung issues. Symptoms include swollen, bleeding gums, and pus. Proper oral hygiene can help prevent it.

4. Cracked Teeth

Cracks can be caused by injury, grinding, or chewing hard foods. If untreated, cracks may extend into the tooth pulp and may require a root canal.

5. Sensitive Teeth

Also called dentin hypersensitivity, this condition causes pain from hot or cold food and drinks. It can result from tooth decay, gum disease, or thin enamel.

6. Oral Cancer

Affecting the gums, tongue, and mouth, oral cancer is linked to tobacco, alcohol, and HPV. Symptoms include swelling, lumps, and ear pain. Early diagnosis improves treatment success.

LITERATURE REVIEW

A thorough review of national and international journals, reference books, and online sources reveals the growing interest in herbal toothpaste for oral health. Key points include:

1. Ingredients and Benefits

Herbs like Neem, clove, and mint are highlighted for their antibacterial, anti-inflammatory, and plaque-controlling properties.

2. Efficacy and Safety

Studies compare herbal toothpaste with conventional ones for plaque removal, gingival health, and cavity prevention, while addressing safety concerns like allergic reactions.

3. Consumer Perception

Research examines consumer attitudes, including preferences for taste, perceived benefits, and willingness to switch from traditional toothpaste.

4. Clinical Trials

Clinical trials assessing herbal toothpaste efficacy in various populations are reviewed, noting strengths and limitations.

5. Market Trends and Regulation

Discussions cover the growing herbal oral care market, regulatory challenges, and the need for quality consistency in herbal extracts.

6. Future Directions

Suggestions for future research include exploring new herbal combinations, long-term safety studies, and addressing current knowledge gaps.

NEED FOR THE STUDY

1. Neem

Fig. 1: Neem Powder.

Biological Source

Neem is derived from the fresh or dried leaves and seed oil of *Azadirachta indica* (Meliaceae).

Geographical Source

Native to India, Neem is also found in Nepal, Pakistan, Bangladesh, and Sri Lanka. It is an evergreen tree that grows 15-20m tall, sometimes up to 35-40m.

Chemical Constituents

Active compounds include azadirachtin, nimbolinin, nimbin, nimbidin, nimbidol, sodium nimbinate, gedunin, salannin, and quercetin.

Uses

Neem bark is used in toothpastes and tooth powders for its antibacterial properties. Neem twigs help relieve toothaches, act as oral deodorants, and aid in cleaning teeth.

1. Babul Tree

Fig. 2: Babul Tree.

Biological Source

Babul (*Acacia nilotica*) is also known as the gum Arabic tree, thorn mimosa, or Egyptian acacia. Family: Fabaceae

Chemical Constituents

The gum contains calcium, magnesium, potassium, malic acid, and sugar. Bark and pods are rich in tannins.

Uses

Babul bark, with tannins and gallic acid, has antibacterial, anti-inflammatory, astringent, and haemostatic properties. It helps reduce plaque and gingival inflammation.

2. Guava leaves

Fig. 3: Guava Leaves Powder.

Biological Source

Guava (*Psidium guajava*), a small tropical tree or shrub.

Family: Myrtaceae. Native to tropical America, cultivated globally for its edible fruits.

Chemical Constituents

Guava leaves contain moisture, ash, fat, protein, carbohydrates, ascorbic acid, and phenolic compounds.

Uses

Guava leaf juice in toothpaste helps clean and whiten teeth. It also has anti-ulcer, antimicrobial, antioxidant, and healing properties for treating oral ulcers.

2. Kalmi bark

Fig. 4: Kalmi Bark (cinnamon).

Biological Source

Cinnamon is the dried inner bark of *Cinnamomum zeylanicum* shoots.

Family: Lauraceae

Synonyms: Cinnamon bark, Kalmi-Dalchini, Ceylon cinnamon

Chemical Constituents

Cinnamon contains compounds such as quinine, quinidine, cinchonine, cinchonidine, and others.

Uses

Cinnamon extracts and compounds show strong antimicrobial activity against oral pathogens, benefiting the prevention of caries, periodontal disease, endodontics, and candidiasis treatment.

Aim

Formulation and Evaluation of Herbal Denture Cleanser (Toothpaste).

Objectives

- Design a herbal cleanser using Neem, Babul, Guava, and Kalmi bark.
- Assess the physicochemical properties.
- Clean, polish teeth, remove stains, and freshen breath.
- Stimulate appetite and promote well-being.
- Maintain oral health and prevent gum issues.

Plan of Work

- **Research**: Investigate herbal ingredients (e.g., Neem, clove, peppermint) for oral health benefits.
- **Formulation**: Create toothpaste recipe with desired properties (anti-bacterial, anti-inflammatory, whitening).
- **Ingredient Sourcing**: Identify reliable, quality suppliers and consider organic options.
- **Regulatory Compliance**: Ensure ingredients and product meet regulatory standards.
- **Prototype Development**: Create prototypes and test combinations for efficacy and flavor.
- **Testing & Evaluation**: Conduct stability, safety, and effectiveness tests.
- **Packaging**: Design eco-friendly packaging reflecting herbal qualities.
- **Production Scale-up**: Partner with a manufacturer that preserves ingredient integrity.
- **Marketing & Launch**: Emphasize natural benefits and launch strategy targeting natural care consumers.
- **Feedback & Iteration**: Gather customer feedback and adjust as needed.
- **Quality Assurance**: Maintain quality control throughout production.

MATERIALS AND INGREDIENTS

Herbal Ingredients

1. Neem powder
2. Guava powder
3. Kalmi bark (cinnamon) powder
4. Babul powder

Collection

Ingredients collected from Krishnarao Bhegade Institute's medicinal garden, Talegaon Dabhade, Maharashtra.

Physical Examination

- **Neem**: Green, bitter.
- **Guava**: Dark green, slightly bitter, aromatic.
- **Kalmi bark**: Brown, sweet and spicy, aromatic.
- **Babul**: Green, bitter, faint odor.

Chemical Ingredients

1. **Calcium Carbonate**: Abrasive, polishes enamel.
2. **Para Hydroxy Benzoic Acid**: Preservative.
3. **Sodium Lauryl Sulfate**: Detergent.
4. **Sodium Chloride**: Abrasive, removes stains.
5. **Camphor**: Antiseptic, freshens breath.
6. **Honey**: Antibacterial.

Here's a more concise version for review:

Formulation

Herbal ingredients (Neem, Guava, Kalmi bark, Babul) were dried and ground using a domestic mixer. The required quantities of ingredients were weighed and placed in a mortar. Calcium carbonate, sodium lauryl sulfate, methyl cellulose, honey, and glycerine were mixed with water. Acacia was added, and the solution was added dropwise to the herbal ingredients and triturated until a paste formed.

Table 1: Herbal Ingredients.

Sr. No.	Ingredient	Quantity (g)
1	Kalmi bark powder (cinnamon)	0.5
2	Guava leaves powder	0.5
3	Babul leaves powder	0.5
4	Neem powder	0.5

Table 2: Chemical Ingredients.

Sr. No.	Ingredient	Quantity (g)
1	Camphor	0.5
2	Honey	0.5
3	Calcium carbonate	3.5
4	Glycerine	2.0
5	Para hydroxy benzoic acid	0.3
6	Sodium lauryl sulfate	0.5
7	Sodium chloride	0.2
8	Distilled water	q.s