



Assessment of Pediatric Herbal Toothpaste For Oral Health Benefits

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Abstract.

Interest in herbal toothpaste substitutes has increased due to the growing need for safe and efficient dental care products, particularly for kids. The creation and assessment of a children's herbal toothpaste using natural ingredients including neem, clove, babool, ritha, turmeric, and stevia is the main goal of this study. Because of their shown antibacterial, antiseptic, anti-inflammatory, and cleaning qualities, these ingredients were chosen. Herbal powders were carefully dried, ground, and combined with humectants and flavorings as part of the formulation process to produce a kid-friendly, potent mouthwash. Physical, chemical, and performance tests were performed on the prepared herbal toothpaste, including measurements of pH, foamability, spreadability, moisture content, and abrasiveness. The formulation satisfied ideal parameters for pediatric use, according to the results, and provided a natural, fluoride-free, and enticing substitute that promotes good oral hygiene, lowers the risk of cavities, and helps kids develop good brushing habits. In pediatric dentistry, the study emphasizes the potential of herbal dental care formulations as a secure, economical, and eco-friendly choice.

Keywords: Herbal Cosmetics, Oral Cosmetics, Herb, Teeth Formulation.

1. Introduction:

1.1 Herbal cosmetic:

Herbal cosmetics refer to products made with one or more herbs or processed herbal ingredients in specific quantities to offer particular nutritional, cosmetic, or therapeutic effects for diagnosing, treating, or alleviating diseases in humans or animals, as well as altering their anatomy or physiology. These herbal compounds undergo various processes, such as extraction, distillation, expression, fractionation, purification, concentration, or fermentation, to create herbal medicines. Examples include comminuted or powdered herbs, tinctures, extracts, essential oils, expressed juices, and processed exudates.

Traditionally, herbal remedies have been employed to address gum and tooth problems. In many cultures, plastic-bristle toothbrushes are rare; instead, people often utilize herbal "chewing sticks." These sticks are typically crafted from trees, shrubs, or plants known for their high antibacterial properties. The tips of chosen sticks are frayed and used to clean between the teeth and massage the gums. [1]

Herbal cosmetics are the preferred choice for customers due to their effectiveness, availability, and perceived lower risk of side effects. [2] In recent years, there has been a growing demand for herbs in cosmetics because they are gentle, less toxic, and often more effective. The pursuit of beauty has created a significant market for herbal cosmetics. Nowadays, the desire to appear younger, attractive, fresh, charming, and fair has directly boosted the demand for both herbal cosmetics and cosmeceuticals [3]

1.2. Oral cosmetics:

Dentifrices are products meant for external application that clean both the teeth and surrounding areas. In contrast, mouth fresheners are consumed internally to alleviate nausea and other discomforts. They help refresh and clean the mouth's interior, aiding in the prevention of dental cavities and gum diseases. To maintain good oral health, it is essential to avoid dental and periodontal problems. Dentifrices can be further classified into three types based on their form: toothpaste, fluid toothpaste, and liquid dentifrice. Tooth powder is the most widely used form, followed by moist (semi-kneaded) tooth powder. A specific amount of mouthwash is swished around in the mouth before being expelled as a liquid dentifrice. This chapter also discusses the functions of mouthwash, including its role in refreshing and cleaning the mouth. Additionally, mouthwashes containing medicinal ingredients can help prevent dental caries and periodontal issues. [1]

Oral hygiene can be upheld during the day by utilizing different types of toothpaste made from both herbal and synthetic components. In this study, a toothpaste was formulated using various herbal ingredients known for their antibacterial, antiseptic, and cooling effects. [4] Toothpaste and mouthwashes are the primary products utilized for oral health and beauty, resulting in a strong demand for them. This category encompasses both chemical and herbal formulations.

1.2.1 Structure of teeth and function of teeth:

Enamel, which originates from epithelial tissue, covers the crown of each tooth. On the other hand, dentin and cementum arise from mesenchymal tissue. Dentin constitutes the majority of the tooth and is found in both the crown and root, while cementum is only formed on the root area atop the newly mineralized dentin matrix. [5]

Function of teeth:

- 1) Biting of food materials
- 2) Appearance

1.2.2. Anatomy Physiology of teeth:

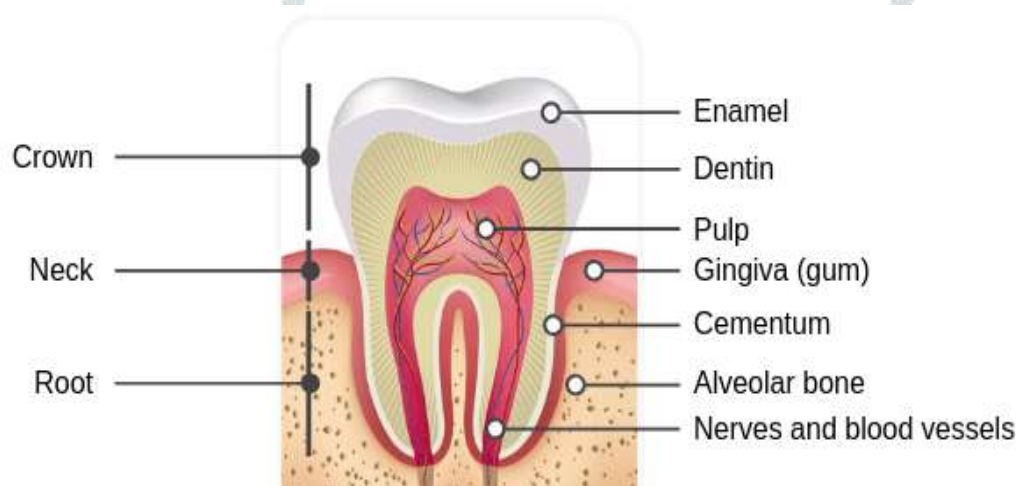


Figure No: 1

1.3. Different Types of oral formulation:[6]

- **Herbal chewing tablet:**

Herbal chewing tablets serve as a significant and convenient alternative to traditional tablets for dental conditions. Chewable tablets offer extra benefits for patients by enhancing adherence, improving the user experience, and addressing challenges with swallowing.

- **Herbal Gel:**

Herbal gels are more effective as a means of topical drug delivery than ointments due to their non-sticky nature, lower energy requirements in formulation, stability, and aesthetic appeal. They offer multiple benefits over traditional gels by reducing side effects and enhancing therapeutic effectiveness. Additionally, herbal gels with appropriate rheological properties can improve the absorption of poorly absorbed drugs by extending their contact time with the skin.

- **Herbal Lollipops:**

Herbal lollipops are candy that doesn't contain sugar. They are made with licorice extracts and follow a special sugar-free recipe recommended by Dr. John's Candy. The research indicated that the sugar-free lollipops were safe and that their ability to fight bacteria that cause cavities remained strong in the formulas designed for use.

- **Herbal Mouthwash:**

Mouthwashes are strong liquid solutions that contain anti-microbial ingredients. People usually mix them with water before using them in their mouths to help fight infections, clean their mouths, and keep them fresh. Herbal mouthwashes offer several health benefits, such as easing symptoms of gingivitis, canker sores, swollen gums, sore mouths, irritated or ulcerated throats, mouth infections, bleeding gums, and sensitive teeth.

- **Herbal Toothpaste:**

Herbal toothpaste is made from a mix of carefully chosen herbs that help fight bacteria and strengthen gums, giving you complete dental care. It includes the natural flavors of various ingredients such as elaichi (cardamom) and lavang (cloves).

The herbal toothpaste uses an old and well-known Ayurvedic recipe that offers strong protection against cavities and other problems related to teeth and gums. This herbal toothpaste not only defends against germs that cause dental plaque, but it also contains antioxidants from a blend of extracts that you won't find in regular toothpaste.

- **Herbal powder:**

Herbal tooth powder is a natural product used for cleaning teeth. It helps freshen breath, heal gums, fight bacteria, and lower inflammation in the mouth. People have used herbal tooth powder for hundreds of years. The ingredients in tooth powder and toothpaste are similar, but tooth powder doesn't have humectants, water, or binding agents. The main purpose of tooth powder is to clean the visible parts of the teeth.

The mixture was kept in a sealed wide-mouth container for later use. The ingredients in the tooth powder are well-known for fighting the germs found in the mouth. They have proven to be effective against harmful dental bacteria like *Lactobacillus acidophilus*, *Streptococcus salivarius*, *Streptococcus sanguinis*, *Staphylococcus aureus*, and *Streptococcus mutans*. The herbal tooth powder showed a drop in the number of oral bacteria, likely because of the active ingredients, natural extracts, and combinations of natural oils that may help kill bacteria.

1.4. Advantages of Herbal Toothpaste in Children:

- 1) Composed of organic plant-based components (such as clove, babool, and neem).
- 2) Lessens exposure to artificial flavors, preservatives, and chemicals.
- 3) Options devoid of fluoride minimize the chance of fluorosis from toothpaste ingestion.
- 4) Incorporates natural antibacterial ingredients to help manage gum disease and plaque.
- 5) Young children may tolerate milder flavors better.

1.5. Disadvantages of herbal toothpaste in children:

- 1) In older children, a lack of fluoride may lessen their defense against cavities.
- 2) There is frequently a lack of scientific proof for effectiveness.
- 3) The possibility of adverse reactions to extracts from herbs.
- 4) Children may find certain herbal flavors disagreeable.
- 5) Herbal toothpastes can cost more than conventional ones.

1.6. Herbs used for dental diseases:

1. Miswak(Persica Salvadora):

Miswak, often called a chewing stick, belongs to the Salvadoraceae family. People have used Miswak for dental care since ancient times. Studies have proven that it helps prevent tooth decay, and the World Health Organization recommends it as a helpful tool for oral hygiene. This dental stick is also affordable for most people. Users of Miswak experience less bleeding in their gums, better gum health, and less bone loss between their teeth compared to those who use regular toothbrushes. [7]

2. Triphala:

Researchers compared alcohol extracts of Triphala and its components and found that they are powerful antioxidants. Triphala also effectively stopped the breakdown of red blood cells caused by superoxide. Additionally, the extracts prevented lipid peroxidation in rat liver mitochondria, which was triggered by the $\text{Fe}^{3+}/\text{ADP}/\text{Ascorbate}$ system. The main phenolic compounds found in the alcohol extracts were identified as tannins.

Triphala exhibits strong antimicrobial, antioxidant, and anti-collagenase properties. The antioxidants in Triphala help lessen oxidative stress and shield cells from damage caused by free radicals. Among its components, Bahera is the most potent antioxidant, followed by Amalaki and Haritaki. [8]

3. Honey:

Honey's sweetness and its antibacterial properties are beneficial for the gums. It provides the essential nutrients needed to maintain healthy gums and is rich in vitamins and minerals. Research indicated that honey solutions can affect monocyte activity in laboratory settings. Propolis, another substance found in bee products, has shown to fight against *Streptococcus mutans* in mouth rinses. This means that mouth rinses with propolis could serve as a possible alternative for preventing tooth decay and decreasing plaque buildup and the production of polysaccharides. [7]

4. Aloe vera:

Aloe barbadensis is a plant that is part of the Lily family. As a xerophyte, it can store a lot of water and adjust to changes in water availability. This plant contains natural compounds called anthraquinones that have antimicrobial properties, including resins, anthranol, ethereal oil, chrysophanic acid, barbaloin, aloin, aloetic acid, isobarbaloin, and anthracene.

2. Method And Material:

Table No: 1

Sr.no	Common Name	Figure	Category
1	Neem: Synonym - <i>Azadirachta indica</i> Family: <i>meliaceae</i>		1. Numerous scientific studies have shown that it has antibacterial properties [9]. 2. Neem has demonstrated antibacterial [10].
2	Babool: Synonym-Prickly acacia Family: <i>Fabaceae</i>		1. Powdered babool bark strengthens teeth and prevents gum disease and dental cavities. 2. Babool bark can be gargled to relieve bleeding gums [11]
3	Clove: Synonym- <i>Syzygium aromaticum</i> Family: <i>Myrtaceae</i>		1. Cloves help to lessen infection since they are antiseptic.[12] 2 .Cloves as a dental analgesic [13]
4	Ritha: Synonym-Soapnut Family: <i>Sapindaceae</i>		1.Creates a soft, natural foam without harsh chemicals like SLS 2. Leaves the mouth feeling clean and fresh without artificial flavoring.
5	Turmeric: Synonym- <i>Curcuma longa</i> Family: <i>Zingiberaceae</i>		1.It has medicinal properties, such as analgesic, antioxidant, and anti-inflammatory properties.

6	Stevia: Synonym-Stevia rebaudian Family:Asteraceae		1.It used to make novel dental toothpaste. The plant is a non-caloric natural sweetener and sugar alternative.[15]
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1. Neem:

Neem twigs have long been used as teeth brushes by people in Africa and India. The antibacterial components found in neem twigs are essential for maintaining tooth hygiene. Additionally, neem powder is utilized for gum massage and tooth brushing. Numerous studies conducted in Germany have demonstrated that neem extracts guard against periodontal disease and tooth decay. Daily usage of neem mouth rinse or neem leaf extract added to water has been shown to effectively treat infections, tooth decay, bleeding, and sore gums. After just a few months of neem use, several persons have reported a complete reversal of gum deterioration

2. Babool:

For millennia, people have understood the value of acacia plants in both animal nutrition and the prevention and treatment of both human and animal illnesses. The gum Arabica tree, *Acacia nilotica*, yields babul extract, which is extremely rich in secondary metabolites such fatty acids, alkaloids, tannins, flavonoids, and terpenes. Antioxidative, anti-inflammatory, anthelmintic, antidiarrheal, antispasmodic, antihypertensive, antibacterial, antifungal, antidiabetic, antiplatelet aggregators, antiplasmodial, antimutagenic, anticancer, acetylcholinesterase-inhibiting, diuretic, antipyretic, analgesic, and numerous other effects are all exhibited by these compounds.

3. Clove:

In addition to their culinary applications and fragrant smell, cloves have several dental health advantages. The essential oils and nutrients found in these small, dried clove tree flower buds can help us maintain better oral hygiene. Cloves have been utilized for ages in traditional medicine for their therapeutic qualities, which range from treating toothaches to combating bacteria. This blog post will discuss the benefits of cloves for your teeth and how to include them in your daily oral hygiene regimen.

4. Ritha:

also known as Reetha or Soapnut, is traditionally used for hair care and skin cleansing due to its gentle and non-stripping properties. Antimicrobial properties: Ritha has been shown to have antimicrobial properties, which could help control bacteria in the mouth. Anti-inflammatory properties: Ritha may help reduce inflammation, which could be beneficial for gum health.

5. Turmeric:

also known as *Curcuma longa*, is a flowering plant in the ginger family, native to the Indian subcontinent and Southeast Asia. Its rhizome, or underground stem, is commonly used as a spice and for medicinal purposes. Culinary: Turmeric is a key ingredient in many Asian dishes, particularly curries, and is used to impart a yellow color and flavor to food.

Traditional Medicine: Turmeric has been used in traditional medicine systems like Ayurveda, Siddha, and traditional Chinese medicine for various conditions, including indigestion, arthritis, and skin infections

Anti-inflammatory Properties: Turmeric contains curcuminoids, which have potential anti-inflammatory properties, although more research is needed to confirm its effectiveness.

Liver Health: Turmeric supplements have been linked to liver damage in some cases, particularly those with high bioavailability.

6. Stevia:

Is a natural, zero-calorie sweetener derived from the *Stevia rebaudiana* plant, native to South America. It's been used for centuries as a sugar substitute and flavoring ingredient. Here are some key points about stevia. Origin: Stevia is cultivated in many parts of the world, including Paraguay, Kenya, China, and the United States. Sweetness: Stevia contains steviol glycosides, which are 250-300 times sweeter than sucrose. Production: High-purity stevia leaf extract is made by steeping dried leaves in hot water, filtering, and purifying the liquid extract. Stevia is used in foods and beverages to reduce energy and added sugar content, and can be found in products like soft drinks, canned fruit, ice cream, and baked goods.

2.1. Method:

2.1.1. powder Procedure:

1. Gather Leaves: Select young, healthy, green neem leaves.
2. Give the leaves a thorough wash: To get rid of dirt and insects, rinse them in clean water.

3. Allow the leaves to dry: In a well-ventilated, shady spot, arrange the leaves in a single layer. To make them crisp, let them air-dry for 7–10 days. To protect nutrients, stay out of direct sunshine.

4. Grind into Powder: Using a blender or grinder, grind the leaves into a fine powder when they have completely dried.

5. Sieve (Optional): For a smoother powder, use a sieve to get rid of bigger particles.

2.1.2. Formulation Table:

Table No: 2

Sr no	Ingredients	Quantity taken	Roles
1	Neem	0.15 gm	Antibacterial
2	Clove	0.06 gm	Antiseptic
3	Babool	0.3 gm	Cleaning of teeth
4	Ritha	0.3 gm	Foaming Agent
5	Turmeric	0.15 gm	Whitening Agent
6	Stevia	0.3 gm	Sweetening Agent
7	Glycerin	3 ml	Humectant
8	Strawberry	0.5 ml	Flavoring Agent
9	Water	qs	Vehicles

2.1.3. Procedure:

1. First wash the neem leaves with water.
2. After washing of neem shade dry of remaining herbs (clove, babool, ritha)
3. After drying all ingredients grinding separately
4. The grinding of herbs should be fine in size and passing through sieve 80 to maintain particle size.
5. All herbs powder is accurately weigh and add in mortar pestle and triturate them.
6. The add Sweeting (Stevia) agent and whitening agent (turmeric).
7. Then add sufficient quantity of humectant and distilled water drop by drop with continuous stirring.
8. Then add flavoring agent (strawberry) and Triturated well until a paste consistency is form.
9. Then transfer the mixture into a toothpaste container.

3. Result And Discussion:

3.1. Evaluation Study:

3.1.1. Physical Evaluation:

It refers to the evaluation of the herbal Toothpaste by its color, odor, appearance, texture etc. The external characters of the formulation were examined based on the method

3.1.2. Determination of Foamability:

Two grams of toothpaste and five milliliters of water were combined in a measuring cylinder, the initial volume was recorded, and the cylinder was shaken ten times to determine the herbal toothpaste's foaming strength, or foamability. It was calculated how much foam there was overall [17]



Figure No: 2

3.1.3. Determination of Sharp and Edge Abrasive Particles:

Put the contents on your finger and scratch for 15 to 20 cm on the butter paper to look for any sharp or abrasive particles. At least ten times, repeat the same process [18].

3.1.4. Determination of PH:

The pH of a formulation of herbal toothpaste was measured with a pH meter. 10grams of toothpaste were put into a 150 ml beaker. Add ten milliliters of hot and cooled water. Stir vigorously to form a Suspension.[19]

Figure No: 3



3.1.5. Determination of spreadability:

The spreadability of paste is assessed based on its slide and drag properties. Two glass slides (10 x 10 cm) were positioned one on top of the other (no sliding was permitted), and 1-2g of herbal toothpaste was weighed and sandwiched between them. The slides were then moved in opposite directions. Measure the toothpaste spreading in centimeters after three minutes. The experiment is repeated using the average of the three recorded measurements. [20]

3.1.6. Determination of Moisture content and volatile matter:

Five grams of herbal toothpaste were put in a porcelain dish that was six to eight centimeters in diameter and two to four centimeters deep in order to measure the moisture and volatile matter content. The temperature at which it was dried was 1050C.

Calculation:

$$\% \text{ by mass} = 100\text{MI}/\text{M}$$

MI - Loss of mass(g) on drying.

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



Figure No: 4

- Physical Evaluation:

Table No: 3

Sr.no	Parameter	Observation
1	Colour	Brown
2	Odour	Characteristics
3	Taste	sweet
4	Smoothness	Smooth

- Evaluation Result:

Table No: 4

Sr.no	Parameter	Observation
1	Foamability	10 ml
2	Abrasiveness	Good

3	PH calculation	6.87
4	Determination of finess	Good
5	Moisture Content	15%
6	Determination of Spreadability	2.5cm/sec

4. conclusion:

The creation and assessment of a children's herbal toothpaste formulation emphasizes the value of natural, safe substitutes in kid dental care. This herbal formulation steers clear of potentially hazardous additives like hydrogen peroxide (H₂O₂) and sodium lauryl sulfate (SLS), which are frequently included in traditional toothpastes. Common foaming agents like SLS can irritate mucous membranes, trigger allergic reactions, and worsen pediatric mouth ulcers. When applied often to developing teeth, H₂O₂, which is frequently used for teeth whitening, can cause gum irritation, enamel erosion, and increased tooth sensitivity.

The herbal toothpaste has strong antibacterial, anti-inflammatory, and cleaning qualities without causing negative side effects by substituting natural ingredients like neem, clove, babool, ritha, turmeric, and stevia for these harsh chemicals. Key characteristics like pH, spreadability, foamability, and moisture content were evaluated, and the results verified that the herbal toothpaste is safe and beneficial for kids. The strawberry flavor increases acceptance, which facilitates the promotion of regular dental care practices among young users. According to this study, herbal toothpaste is a good, kid-friendly substitute that promotes oral health while reducing exposure to chemicals, which makes it particularly useful for early dental care.

5. Future Prospective:

The herbal toothpaste project has promising future prospects due to growing demand for natural and eco-friendly oral care products. It can capture a significant market share, especially in pediatric dentistry, and expand globally, driven by increasing awareness of oral hygiene and preference for herbal products.

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