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Polyherbal dentifrice: A review of literature

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Abstract

Overall well-being depends on one's oral health. It impacts not just our general health but also our capacity to eat; speak; and smile with assurance. Numerous systemic disorders; Poor oral health has been linked to conditions including diabetes; heart disease; and respiratory infections. Toothpaste is essential for preserving dental health. Plaque and germs are eliminated; cavities are avoided; foul breath is lessened; and gum disease is avoided. Certain toothpastes have components that can help whiten teeth and get rid of surface stains. Growing knowledge of natural components: People are looking for natural substitutes for synthetic chemicals as they become more aware of the substances in the items they consume. Concerns about chemical exposure is the Many people are concerned about the potential long-term health effects of exposure to chemicals found in conventional toothpastes. Polyherbal toothpastes; composed of a blend of natural herbs; offer a range of pharmacological activities that contribute to oral health. People are trying to replace these products with safe; affordable; and natural alternatives that have notable effects. The effectiveness of natural excipients as teeth-whitening agents was the main topic of this paper.

Keywords: Dentifrices; Herbal plant; Oral hygiene; Teeth; whitening; Tamarind seeds

1. Introduction

People have been using toothpastes since ancient times, and they are currently one of the most important and necessary components of oral healthcare. Dental care, or oral health, is vital to overall health. [1] Another name for it would be the practice of keeping one's mouth clean in order to prevent dental problems. To avoid future dental problems, people should maintain proper oral hygiene and keep their mouths free of diseases and other frequent problems, such as bad breath. In China and India, toothpaste compositions were created between 300 and 500 BC. Today, the focus is on the release of active ingredients during formulation development in order to prevent and/or treat oral diseases. [1] Toothpaste is a dentifrice used to maintain, improve, and clean the health of teeth. The prevention of oral health problems and bad breath depends on maintaining proper dental hygiene. Gum disease, cavities, dental caries, toothaches, and periodontitis and gingivitis are the most common dental problems that occur. Cleaning teeth entails clearing the mouth of dental tartar and plaque. [2] A toothpaste's main purpose is to clean teeth, which is seen as a cosmetic advantage. Cosmetic claims include the use of terms like "protects," "cleans," "freshens breath," "fights bacteria which may cause gum problems," "whitens," and "fights tartar." [3] Although toothpastes, also known as dentifrices, have been used since ancient times, new formulations that contain active ingredients to prevent and/or treat oral disorders have recently been created. A review of toothpaste history can be found elsewhere. [3] Eighty percent of people utilize medicinal plants for basic healthcare, according to the World Health Organization (WHO). The chemical compounds utilized in toothpaste formulation might cause hypersensitivity responses, tooth discoloration, and changed flavor. Consequently, the buccal cavity is not harmed using natural components devoid of artificial sweets, fragrances, or preservatives [4] . A natural substitute for conventional whitening treatments are toothpastes made with polyherbal ingredients. A combination of herbal compounds included in these toothpastes is thought to help whiten teeth and

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enhance oral health. They can be a kinder and more natural alternative, even if they might not have the same whitening effectiveness as certain store-bought treatments.

1.1. Ideal properties of toothpaste

- **Fluoride:** Essential for preventing cavities by strengthening tooth enamel.
- **Mild Abrasives:** Help remove plaque and surface stains without damaging enamel. Examples include calcium carbonate and silica.
- **Antibacterial Agents:** Combat bacteria that cause plaque and gum disease. Triclosan and stannous fluoride are common examples. [25]

1.2. Additional Desirable Features

- Sensitivity Relief: Ingredients like potassium nitrate or strontium chloride can help reduce sensitivity to hot, cold, or sweet stimuli.[18]
- Whitening Agents: These can help remove surface stains and brighten your smile. Hydrogen peroxide and blue covarine are common whitening agents.
- Tartar Control: Ingredients like pyrophosphates can help prevent tartar buildup.
- Pleasant Taste and Aroma: A good-tasting toothpaste can make brushing more enjoyable.
- Safe and Non-Toxic Ingredients: The toothpaste should be free from harmful chemicals and allergens. [22]

2. Anatomy and physiology of teeth

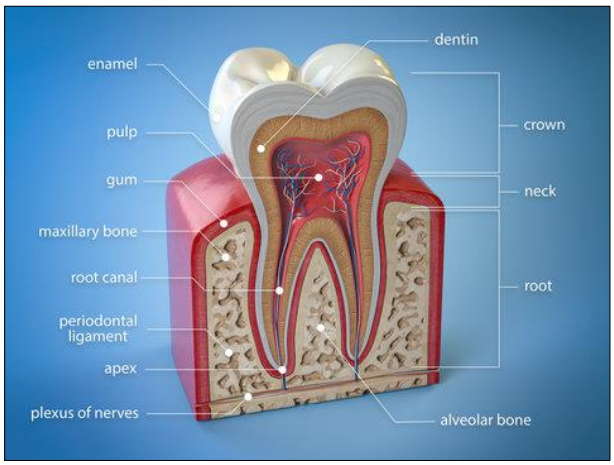

Figure 1 Anatomy of teeth

2.1. A tooth is composed of several layers

- Enamel is the toughest component in the human body and forms the outer layer of the crown. It is mostly composed of calcium phosphate. [5]
- Dentin is a calcified tissue underlying the enamel. It is less hard than enamel yet has great strength [6]
- Pulp is the soft, living tissue in the core of the tooth. It includes blood arteries, nerves, and connective tissue.
- Cementum is a thin coating of bone-like tissue that anchors teeth to the jawbone.
- Periodontal ligament is a fibrous tissue that joins the cementum to the alveolar bone, which retains teeth in place.[6]

2.2. Parts of a Tooth

- Crown: The visible part of the tooth above the gum line.
- Neck: The area where the crown meets the root.
- Root: The part of the tooth below the gum line.

2.3. Physiology of a Tooth

The primary function of a tooth is to assist in mastication (chewing). This involves:

- Incisors: Cutting food into smaller pieces.
- Canines: Tearing and ripping food.
- Premolars and molars: Grinding food into a fine paste.
- He periodontal ligament ensures tooth stability.

It works as a shock absorber, shielding the tooth from damaging pressures during chewing. It also helps to keep the tooth in the appropriate place within the jawbone. [7]

3. Herbal plant used in dentifrices for tooth whitening

Table 1 Herbal Plants

Name of the plants	family	Chemical constituents
Tamarind seed	Fabaceae	Sugars, Organic Acid, Vitamins, Minerals, Phenolic Compounds, Dietary Fiber, Proteins
Sage	Lamiaceae	Essential Oils, Phenolic compounds, Tannins, Vitamins, Minerals ,dietary fiber
Miswak	Salvadoraceae	Tannins ,Flavonoids, Alkaloids, Essential Oils, Vitamins, Minerals, Saponins
Acacia	Fabaceae	Gums and Resins, Alkaloids, Saponins, Proteins, Minerals, Tannin, Flavonoids
Arak	Moringaceae	Vitamins, Minerals, Proteins, Antioxidants, Glucosinolates, essential oils
Sanguinaria	Papaveraceae	Alkaloids ,Phenolic Compound ,Saponins, Essential Oils, Glycosides
Thyme	Lamiaceae	Essential Oils ,Flavonoids, Phenolic compounds, Tannins ,Vitamins, Minerals
Chamomile	Asteraceae	Essential Oils, Flavonoids, Phenolic Compounds, Tannins, Coumarin, Vitamins
Trifala	Combretaceae	Tannins, Flavonoids, Phenolic Compounds, Vitamins, Minerals, Saponin, Alkaloids:
Turmeric	Zingiberaceae	Curcuminoids, Essential Oils, Tannins, Phenolic Compounds, Vitamins, Minerals
Aloe	Asphodelaceae	Aloe Gel, Anthraquinones, Vitamins, Mineral, Enzymes, Saponins
Ashwagandha	Solanaceae	Alkaloids, Withanolides, Saponins, Phenolic Compounds, Vitamins and Minerals
Tea tree oil	Myrtaceae	Terpinen-4-ol, A-Terpineol, 1,8-Cineole ,Limonene, Γ-Terpinene , Other Compounds
Coconut water	Arecaceae	Water, Electrolytes ,Sugars, Vitamins, Amino Acids, Antioxidant
Clove	Myrtaceae	Eugenol, Acetyl eugenol β-caryophyllene , Vanillin, Tannin, Flavonoids
Neem	Meliaceae	Azadirachtin, Nimbidin, Nimbin, Triterpenoids, Flavonoids, Phenolic compounds
Propolis	Apidae	Flavonoids, Phenolic Acids, Terpenes, Essential Oils, Vitamins ,Minerals
Mustard tree	Salvadoraceae	Tannins, Alkaloids, Flavonoids, Essential Oils, Saponins, Minerals
Holy basil	Lamiaceae	Essential Oils, Flavonoids, Phenolic Compounds, Triterpenoids, Vitamins ,Minerals
Pepper mint	Lamiaceae	Essential oils, Menthone,1,8-cineole, Flavonoids, Triterpenes, Vitamins and minerals

Spinach	Amaranthaceae	Vitamins, Minerals, Antioxidants, Oxalic Acid, Dietary Fiber, Protein
Honey	Apidae	Sugars, Water Acids, Vitamin, Minerals, Antioxidants, Enzymes
Guava	Myrtaceae	Vitamins, Minerals, Fiber, Phenolic Compounds, Carotenoids, Essential Oil
Ginger	Zingiberaceae	Gingerol, Shogaol, Zingiberene ,Paradols, Vitamins and Minerals
Nutmeg	Myristicaceae.	Myristicin, Eugenol, Safrole, Camphene, Other Compounds
Fenugreek	Fabaceae	Saponins, Flavonoids ,Alkaloids, Furostanol Saponins, Amino, Acids, Vitamins and Minerals, Essential Oils
Pomegranate	Lythraceae	Punicalagins , Ellagic acid, anthocyanins, tannins, vitamin c, fiber, minerals
Babul	Fabaceae (leguminosae)	Tannins, Flavonoids, Alkaloids, Saponins ,essential oils, Glycosides, phenolic compounds
Cinnamon	Lauraceae	Cinnamaldehyde, Cinnamic acid, Eugenol, Linalool, Coumarin, Tannins, Flavonoids
Walnut	Juglandaceae	Fatty acids:omega-3 fatty acidsm,omega-6 fatty acids Phenolic compounds, Vitamins: vitamin e, b, minerals magnesium, phosphorus, copper, manganese, Proteins-fiber, Melatonin
Camphor	Lauraceae	Camphor, Borneol, Limonene, 1,8-Cineole (Eucalyptol), Terpenes and Terpenoids, Safrole
Lemon	Rutaceae	Citric Acid, Vitamin C (Ascorbic Acid), Flavonoids, Essential Oils: Limonene: Citral, Carotenoids,Pectin Minerals
Orange peel	Rutaceae	Essential Oils:, Limonene: Linalool: Myrcene, Flavonoids: Hesperidin: Naringin Pectin: Phenolic Compounds, Citric Acid
Papaya	Caricaceae	Papain vitamins :vitamin c, vitamin a, b vitamins carotenoids: Beta-carotene: lycopene Flavonoids, fiber. minerals: Potassium, magnesium phenolic compounds

4. Formulation of herbal toothpaste: [11]

Table 2 [11] Formulation of BASE

Sr. No.	Ingredients	Quantity (gm)	Role in the formulation
1	Calcium carbonate	10	Abrasive
2	Sorbitol	2	Sweeting agent
3	Sodium Lauryl Sulphate	1	Foaming agent
4	Sodium Benzoate	0.5	Preservative
5	Glycerin	2	Humectant
6	Sodium chloride	0.5	Stain remover
7	Peppermint oil	0.5	Flavouring agent
8	Distilled water	q. s	Vehicle

Table 3 [11] Formulation of active and additional ingredients

Sr. No.	INGREDIENTS	QUANTITY	ROLE
1	Tamarind seed powder	2gm	Antibacterial, teeth strengthner,teeth whitener
2	Walnut shell powder	2gm	Cleanser
3	Cinnamon oil	0.5	Anti-inflammatory
4	Clove oil	0.5	Anesthetic antibacterial
5	Mustard seed oil	0.5	Provide shine and strength

5. Pharmacological activities of herbs in polyherbal dentifrices

5.1. Antibacterial activity

Herbal substances with antibacterial qualities that have been utilized for centuries are frequently found in herbal toothpaste [8]. These components have the potential to lessen the development of dangerous oral bacteria, which can lead to problems with gum disease, cavities, and foul breath [20] However, the precise components and their concentrations can affect the antibacterial action. Cell Membrane Disruption: A variety of herbal extracts have the ability to cause bacterial cell membrane disruption, which results in cell lysis and death. Inhibition of Enzymatic Activity: Herbal substances have the ability to disrupt bacterial metabolism, preventing the development and reproduction of bacteria. Biofilm Disruption: Certain herbal components have the ability to break up bacterial biofilms on teeth and gums, which facilitates plaque removal. [12]

5.2. Antioxidant activity

The antioxidant activity of herbal toothpaste is a key factor that helps to maintain oral health by countering oxidative stress in the oral cavity [9]. Gum Health: Antioxidants prevent inflammation and oxidative damage to gum tissues, minimizing the incidence of periodontal disease. Cavity Prevention: Because antioxidants preserve enamel and reduce oxidative stress, they may help prevent the formation of cavities. Fresh Breath: Antioxidant qualities can also help to keep your breath fresh by battling microorganisms that cause foul smells. [14] Herbal toothpaste can provide considerable antioxidant advantages, promoting overall dental health. These solutions, which include antioxidant-rich components, not only help to avoid dental problems but also improve the overall efficacy of oral hygiene practices.[10]

5.3. Antimicrobial activity

Numerous studies have examined the antimicrobial properties of herbal plants, demonstrating a variety of benefits against different infections. [23] Disruption of Cell Membranes: Numerous herbal substances have the ability to damage bacterial cell membranes, which results in cell death. Inhibition of Metabolic Processes: Certain substances prevent infections from using vital enzymes or metabolic pathways. Biofilm. [15] Disruption: Some herbs have the ability to stop or interfere with the production of biofilms, which improves the effectiveness of other antimicrobial therapies. Because of their bioactive components, herbal plants have a broad spectrum of antibacterial properties. [19] In a time when antibiotic resistance is on the rise, these natural substances provide viable substitutes for manufactured antimicrobials. [13]

5.4. Anti-inflammatory activity

Herbal toothpaste's anti-inflammatory properties are an important component of its possible oral health advantages. [16] This characteristic can help decrease gum inflammation, control disorders such as gingivitis, and improve overall dental hygiene. Inhibition of Pro-Inflammatory Mediators: Many herbal medicines can prevent the creation of cytokines (such as interleukins and tumor necrosis factor-alpha), which play important roles in inflammation. [24] Antioxidant capabilities in herbal substances can help decrease oxidative stress, which frequently exacerbates inflammation. [17] Blocking Enzymatic Activity: Herbal substances can suppress the activity of inflammatory enzymes including COX and lipoxygenase. Herbal toothpaste has substantial anti-inflammatory properties, making it a great choice for people wishing to enhance their dental health. [26] By incorporating anti-inflammatory herbal ingredients, these products can help reduce gum inflammation, alleviate discomfort, and promote overall oral hygiene. [21]

6. Conclusion

Herbal tooth paste, which combines the advantages of natural components with beneficial oral health features, is a convincing substitute for traditional dental care products. A review of many herbal ingredients shows that they have strong antibacterial, antioxidant, and anti-inflammatory properties. These include tamarind seed, walnut shell, neem, clove oil, cinnamon oil, and mustard oil. By encouraging healthier gums and lowering inflammation, these qualities improve general oral hygiene in addition to helping to avoid dental problems like cavities and gum disease.

Furthermore, the increasing inclination of consumers towards sustainable and natural products highlights the significance of herbal toothpaste in the current industry. Herbal formulas provide an all-encompassing approach to dental care, appealing to individuals looking for natural alternatives as worries about synthetic additives and antibiotic resistance grow. The precise mechanisms of action of these herbal components, their long-term effectiveness, and the possibility of synergistic effects when combined should all be further investigated in future studies. Clinical studies will assist create standardized formulations and confirm their efficacy. In conclusion, there is a lot of potential for improving dental health and wellness using herbal toothpaste, thus more research and development in this field is crucial.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that they have no conflict of interest with the research work of any other authors cited in this manuscript.

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