



HERBAL TOOTHPASTE: AN OVERVIEW

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ABSTRACT:

Herbal products for oral and general health care have gained worldwide popularity. People desiring to use herbal products generally consider these products to be relatively safer than products containing synthetic ingredients. In the current context, oral care with the use of herbal toothpastes containing natural ingredients is a more acceptable advertising belief than the use of synthetic based chemicals due to safety. And their effectiveness in reducing toothache and tooth decay and preventing other dental problems to which this generation is sensitive. Based on the increased use of herbal cosmetics, we have attempted to comprehensively evaluate herbal toothpastes that help maintain good oral hygiene and prevent periodontal disorders, reduce stains, gingivitis, calculus and tooth decay. This review provides background information on the antibacterial potential of various herbs, formulations, that can be used in the preparation of toothpaste.

KEYWORDS: Herbal toothpaste, antimicrobial screening, periodontal disorder, gingivitis, dental caries.

INTRODUCTION:

Herbs and herbal toothpastes have been used for many years in ancient life and are one of the key components of oral health care. The production and development of toothpaste began in China and India, between 300 and 500 BC. During this period, crushed bones, powdered eggs and clam shells were used as abrasives in cleaning teeth⁽¹⁾. Until the middle of the 19th century, multiple abrasives, scent, and green lead were used to remove stains from teeth. Arabs relied heavily on rock salt and fine sand to clean their teeth during the Middle Ages. The toothpaste was developed by a dentist named Dr. Washington Wentworth Sheffield in the year 1950 AD⁽²⁾. In the modern era, the release of active ingredients during development and treatment of oral diseases has gained prominence. Dentifrices—either powders or pastes—are used to clean, care for, and enhance the health of teeth. In addition to serving as an abrasive that assists in the removal and veiling of halitosis, toothpaste releases active ingredients like fluoride to aid in the prevention of tooth and gum disease (such as gingivitis) and is primarily used to promote oral hygiene. With the help of excipients, toothpaste is a semi-solid dosage form that is applied with a toothbrush to improve oral hygiene⁽³⁾. Many herbal medicines are very effective because they contain active chemical ingredients like polyphenols, gums, alkaloids, glycosides, and others that have been found to have a variety of biological functions. The scope of evaluating brand-new herbal toothpaste has expanded⁽⁴⁾. According to the World Health Organization (WHO), medicinal plants are used by 80% of people for primary health care. Tooth stains, altered taste, and hypersensitivity reactions may

result from the chemical agents used in toothpaste formulation. Therefore, the use of natural ingredients that do not contain artificial sweeteners, odors, or preservatives does not harm the buccal cavity⁽⁵⁻⁶⁾. Fluoride-containing toothpaste should not be used by children under the age of six due to the risk of dental caries and fluorosis. All of these factors are taken into consideration, and the use of herbal supplements with fewer side effects is getting more attention⁽⁷⁾.

ANATOMY AND PHYSIOLOGY OF TEETH:

There are 16+16 = 32 teeth in the mouth and are embedded in the alveoli or sockets of the alveolar ridges of the upper jaw (maxilla) and lower jaw (mandible). The order of teeth from front to back is Incisors, Canines, Pre-Molars and Molars. A tooth can be divided into three principal portions:

- ✓ Crown: The crown is the portion of above the level of the gums is covered with enamel, the hardest substance in the body that protect the tooth from wear and acids.
- ✓ Neck: The neck or cervix is the constricted junction between the crown and root.
- ✓ Root: The root can consist of one, two or three projections embedded in a socket. Larger teeth like molars will have more than one root

The tooth is composed of three substances. They are:

- Dentine: It forms a major part of the tooth and has bone like structure.
- Enamel: It is the outermost covering that covers the crown of the tooth and harder than the bone.
- Cementum: It is the neck and it is hard as a bone.

The alveolar processes are covered by the gums or gingivae that extend slightly into each socket. In the centre of the tooth is the pulp cavity containing blood vessels, Lymph vessels and Nerves which surrounded by dentine^(8,9).

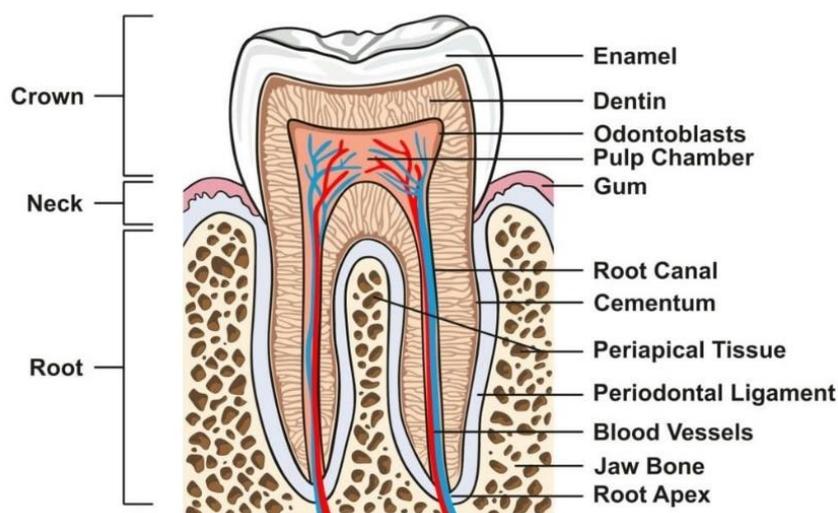


Figure No. 1. Anatomy and physiology of teeth

FUNCTIONS:

The primary function of teeth is mastication, which involves the cutting, mixing, and grinding food to allow the tongue and oropharynx to shape it into a bolus that can be swallowed. The incisors and canine teeth are the cutting teeth and are used for biting off pieces of food. The pre-molars and molar teeth with broad and flat surfaces, are used for grinding or chewing food⁽¹⁰⁾.

IDEAL PROPERTIES OF TOOTHPASTE:

- Non-toxic and non-irritant
- Good abrasive effect
- Inexpensive
- Readily available
- Pleasant flavour
- With fewer side effects
- Keep the mouth fresh and clean
- Long lasting
- Do not cause stain on teeth⁽¹¹⁾.

CLASSIFICATION OF TOOTHPASTE:

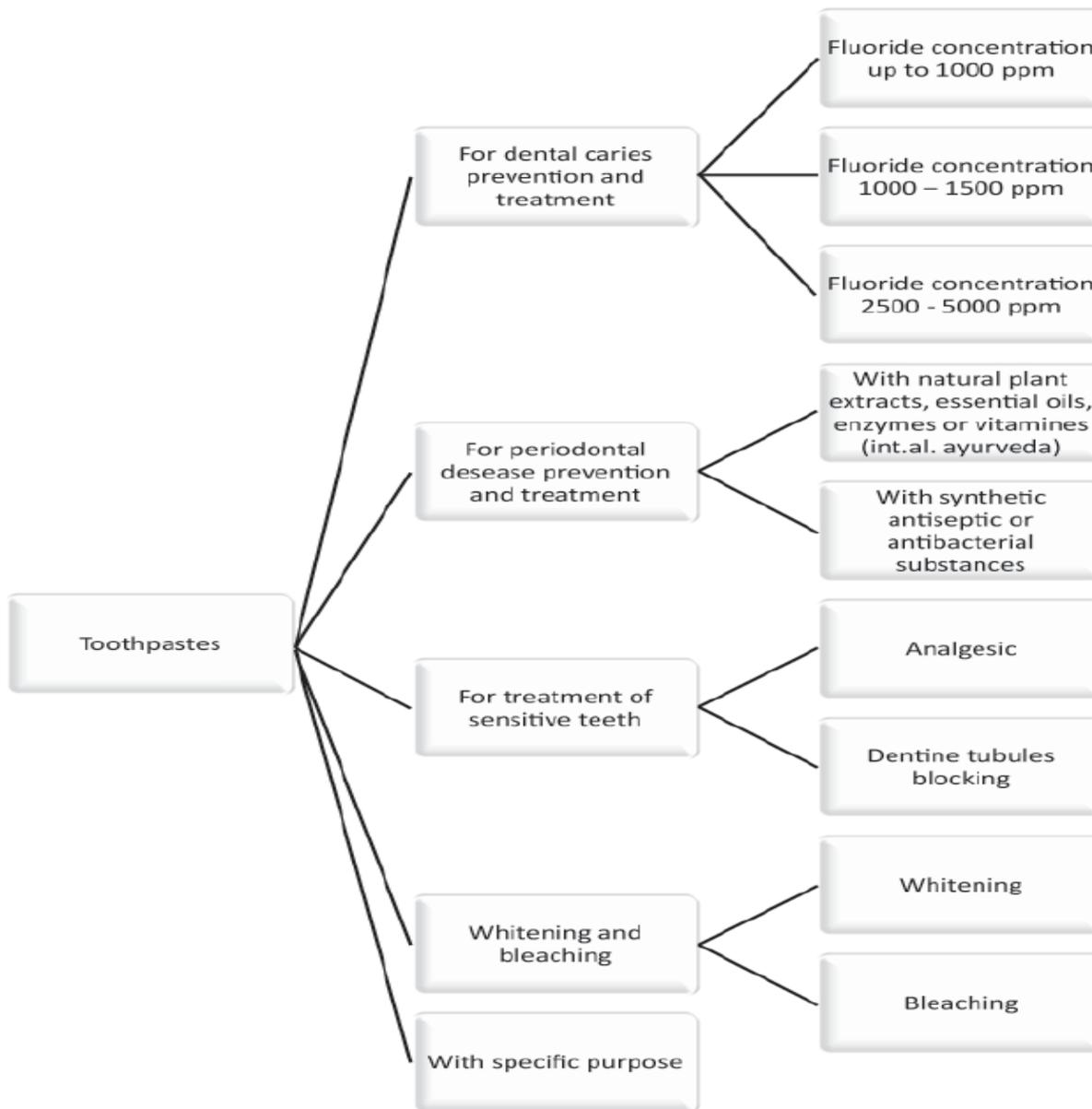


Figure No. 2. Classification of toothpaste⁽¹²⁾.

FORMULATION EXCIPIENTS USED IN TOOTHPASTE**TABLE 1: Formulation excipients used in toothpaste:⁽¹³⁻¹⁷⁾**

Sl.no	Excipients	Concentration range	Types	Uses
1.	Abrasives	9-13%	Dicalcium phosphate, Alumina, calcium carbonate	Remove food debris, stains as well as polishes the tooth surface.
2.	Humectants	37-45%	Glycerol, xylitol, water, PEG 8[Polyethylene glycol esters]	Provide moisture content and prevent formation of plug-in nozzle tube.
3.	Binding agents	0.8-2.5%	Agar, Carrageenan, Gum tragacanth, Isapgol mucilage	Stability and consistency of the toothpaste can be maintained
4.	Preservatives	0.05-0.5%	Formaldehyde, Benzoic acid, Parabens, Phenolics, citric acid.	Prevents growth of micro-organisms and provide stability
5.	Foaming agents	1-2%	Sodium lauryl sulphate, Sodium stearyl lactate, Amine fluorides, Dioctyl sodium sulfosuccinate	Assist in penetration of plaque deposition and enables dispersion
6.	Flavours	1-6%	Clove oil, Peppermint, Eucalyptus, Spearmint, aniseed, Fennel,	aniseed, Fennel,
7.	Colours	1-2%	Titanium chlorophyll dioxide,	Impart colour to the toothpaste
8	Sweeteners	18-24%	Saccharine, Aspartame, Sorbitol, xylitol	Mask palatable taste

TABLE-2: HERBS USED IN DENTISTRY⁽¹⁸⁻³⁸⁾:

S.no	Herbs	Biological source	Chemical constituents	Uses
1.	Ginger	Ginger consists of the rhizome of <i>Zingiber officinale</i> , family <i>Zingiberaceae</i> Roscose and dried in the sun.	Curcumene, phenolic compounds include gingerol, parasols, and shogaol.	Stomachic, carminative, stimulant, flavoring agent, Reduce inflammation and pain, anticariogenic and antimicrobial.
2.	Neem	Neem consist of the fresh or dried leaves and seed oil of <i>Azadirachta Indica</i> , family <i>Meliaceae</i>	Diterpenes (sugiol), nimbiol (bark), triterpenes: beta-sitosterol, stigasterol (leaf), limonoids, Rutin, Nimbin	Antibacterial, Anti-inflammatory, Antiviral, Antisclerotic Toothache reliever.
3.	Aloe vera	Aloe is obtained from the dried juice of leaves of <i>Aloe barbadensis</i> , <i>Aloe ferox</i> , <i>Aloe perryi baker</i> . It is also known as <i>Curacao aloe</i> , <i>Cape aloe</i> , and <i>socotrine aloe</i> , family <i>Asphodelaceae</i> .	Aloin, flavonoids, sterols, amino acids, aloeride.	Antiviral, Antifungal, treatment of mouth ulcer, denture adhesive, osteitis, plaque and gingivitis.
4.	Clove	Clove is the dried flower buds of <i>Eugenia Caryophyllus</i> , <i>Syzygium Aromaticum</i> , family <i>Myrtaceae</i> .	Eugenol, beta-caryophyllene, alpha-humulene, eugenyl acetate, gallic acid, oleanolic acid, ellagic acid	Dental analgesic, Antiseptic, Control of gingivitis, halitosis, plaque.
5.	Turmeric	Turmeric consists of fresh or dried rhizome of <i>Curcuma Longa</i> , family <i>Zingiberaceae</i>	Bisdemethoxycurcumin, Demethoxycurcumin, curcuminoids.	Antibacterial, Antiseptic, Anti-inflammatory, Analgesic, Antioxidant, Astringent, Carminative,
6.	Green tea	Green tea is obtained from evergreen shrub or small tree leaves and leaf	epicatechin, epigallocatechin 3 gallate	Suppresses gum inflammation and gingival oxidative

		buds of <i>Camellia Sinesis</i> , family <i>theaceae</i>		stress.
7.	Triphala	Triphala consist of dried fruits of the three plant species <i>Emblica officinalis</i> (Family <i>Euphorbiaceae</i>), <i>Terminalia bellerica</i> (Family <i>Combretaceae</i>), and <i>Terminalia chebula</i> (Family <i>Combretaceae</i>)	Triphala consists of thiamin, riboflavin, ascorbic acid, β -sitosterol, galloyl glucose, chebulagic acid, chebulinic acid.	Antioxidant, Anti-microbial properties, treatment of ulcerated and bleeding gums as well as in dental caries
8.	Morinda citrifolia	<i>Morinda citrifolia</i> , commonly called <i>Indian mulberry</i> and <i>noni</i> , is a tropical evergreen shrub or small tree, family <i>Rubiaceae</i>	Amino acids, vitamins, proteins, minerals, anthraquinones	Inhibits dental caries caused by <i>Streptococcus Mitis</i> and <i>S. mutans</i>
9.	Citrus medica	<i>Citron</i> or <i>Citrus medica</i> is a large lemon-like fruit borne by a slow growing shrub or small tree, family <i>Rutaceae</i>	Citric acid, d-limonene, hesperidin, diosmin, eriocitrin.	Treatment of scurvy, bleeding gums due to rich, Antioxidant potential
10.	Guduchi	Guduchi is consist of dried, matured pieces of stem of <i>Tinospora Cordifolia</i> , family <i>Menispermaceae</i> .	Alkaloids, tannins, phenols, Glycosides	Treatment of aggressive and chronic periodontitis
11.	Meswak	Meswak is a large, well-branched, and evergreen shrub of <i>Salvadora Persica</i> , family <i>Salvadoraceae</i> .	vitamin C, salvadorine, salvadoura, alkaloids, trimethylamine, cyanogenic glycosides, tannins, saponins and salts mostly as chlorides	Antimicrobial, Antifungal, Antibacterial, Anti-inflammatory, Analgesic, Toothache, Control of dental plaque and cavities used as toothbrush,

12.	Tulsi	Tulsi consists of fresh and dried leaves of <i>Ocimum sanctum</i> Linn., belonging to family <i>Labiatae</i> .	Eugenol, methyl eugenol, carvacrol, terpene, sesquiterpene, beta-caryophyllene, polyphenol rosmarinic acid, linalool, vitamin A and C.	Analgesic, Antibacterial, Anticariogenic, Candidiasis, Antioxidant, Anti-inflammatory, Prevent halitosis, gingivitis, and periodontitis.
13.	Cinnamon	Cinnamon is the dried inner bark of the coppiced shoots of <i>Cinnamomum zeylanicum</i> , family <i>Lauraceae</i> .	Eugenol, caryophyllene, cinnamaldehyde, linalool, cinnamyl acetate.	Antimicrobial, Dental caries, candidiasis, periodontal.
14.	Charcoal	Charcoal is normally obtained from the burning of wood of Gum Arabic (Babool), peat, bones, cellulose, or other carbonaceous substances with little or insufficient air.	Mix of charcoal, activated coal, and bamboo's coal	Remove surface stains, improve bad breath, prevent staining, lowers dental caries.

ANTIMICROBIAL POTENTIAL OF HERBAL TOOTHPASTE OVER CONVENTIONAL TOOTHPASTE:

The study tested the antimicrobial effectiveness of 10 commercially available herbal toothpastes against specific strains of microorganisms using the standard diffusion process at a strength of 1:1 dilution for 24 hours. It found that the herbal toothpaste has antimicrobial properties and is more than conventional toothpaste in this regard⁽³⁹⁾. The effectiveness of herbal toothpaste was compared to that of conventional toothpaste; however, there were no statistically significant differences between the test and control groups. Instead, the herbal-based toothpaste was found to be as effective as conventional toothpaste that was formulated⁽⁴⁰⁾. Eight different herbal toothpaste were used in an in vitro antimicrobial study. The study's efficacy was evaluated by observing the maximum zone of inhibition after 24 hours on Muller Hilton agar media that had been inoculated with microbial stain using the disk diffusion method. The results showed that toothpaste with clove had a stronger antimicrobial property than toothpaste with fluoride, with a ZOI of 22mm⁽⁴¹⁾.

Using cariogenic bacteria like *L. acidophilus* and *S. mutans*, the cup-well method was used to estimate the herbicide's antibacterial activity in comparison to standard Colgate. The standard dentifrice produced a zone

of inhibition of 10.17 mm and 5.83 mm, respectively, whereas the herbal toothpaste produced 10 mm and 5.5 mm. According to the data, arodent is a good toothpaste that is effective against both bacterial strains⁽⁴²⁾. Two commercially available herbal and non-herbal toothpastes had an in vivo effect on the bacterial counts in children's saliva with three to six decayed teeth. Two groups, similar to groups 1 and 2, were randomly assigned to forty children. Group 1 was treated with fluoride containing toothpaste while Group 2 with natural toothpaste. There was no statistically significant difference between the two toothpastes when people were graded on their plaque index and compared their efficacy⁽⁴³⁾.

TABLE-3:ANTIMICROBIAL EFFICACY OF COMMERCIALY AVAILABLE TOOTHPASTE:⁽⁴⁴⁾

Sl No.	Microorganisms	<i>S. Sanguis</i>		<i>S. mutans</i>		<i>C. albicans</i>		<i>A.viscosus</i>	
		24h	48h	24h	48h	24h	48h	24h	48h
	Dentifrice								
1.	Himalaya	0	0	5.4	5.9	0	5.4	6.2	6.4
2.	ViccoVajradanti	0	0	5.2	5.8	0	5.6	6.1	6.5
3.	Dabur Meswak	0	0	6.5	5.6	0	0	6.3	6.5
4.	Colgate Herbal	0	0	6	6.6	0	0	6.1	6.5
5.	Dabur Babool Neem	0	0	5.5	5.9	0	0	6.5	6.5
6.	Dabur Red	0	0	6	5.7	0	5.4	6.5	6.6
7.	K.p. Namboodari's	0	0	5.5	7	0	0	6.4	6.7
8.	Colgate Cibaca	5.4	5.5	7	7	0	0	6.3	6.4
9.	Colgate total	17	19	13	14	0	0	6.2	6.5

EVALUATION PARAMETERS:

1. PHYSICAL EXAMINATION :

- colour– The colour of the toothpaste was visually examined.
- Taste – The taste of the toothpaste was examined orally.
- Odour – The formulation evaluated for its odour by smelling it.
- Smoothness – By rubbing the formulation between the fingers, the paste's smoothness was evaluated.
- Relative Density⁽⁴⁵⁾.

2. PERFORMANCE EVALUATION:

a. Moisture Content:

The weight loss was used to calculate the moisture content by using the formula.

$$\% \text{ Moisture} = \frac{\text{Original sample weight} - \text{Dry sample weight}}{\text{Original sample weight}} \times 100\%$$

b. **Cleaning Ability :**

Eggshells are a good source of tooth enamel that is close enough to natural teeth to test toothpaste's cleaning performance. Each toothpaste that was tested has been given one eggshell.

c. **Foaming Ability**

- Take a substance that was weighed into a glass beaker.
- It should be added to distilled water and left to stand for 30 minutes.
- The beaker's contents were mixed before being poured into a calibrated measuring cylinder.
- The cylinder was then shaken with 12 full shakes and let to stand for 5 minutes after being shaken 1 or more to create a uniform suspension.
- The volume of the foam was determined as ⁽⁴⁶⁾

$$\text{Foaming Ability} = L1 - L2$$

L1 = Volume in ml of foam with water

L2 = Volume in ml of water only

d. **Spread Ability :**

- The following procedure is used to determine the product's spread ability:
- Take a product and place it in the middle of the glass plate.
- Then place second plate over it add 1 kg weight on the highest point of set up cautiously.
- After a period of time, remove the and measure the diameter in cm⁽⁴⁷⁾.

e. **Stability :**

Each of the three glass test tubes contained a portion of the toothpaste and was sealed. After being heated at 45°C for 72 hours, the contents were visually examined for signs of homogeneity, fermentation, and other deterioration, and the results were reported as pass or fail⁽⁴⁸⁾.

f. **Composition :**

The Indian Standards should be followed by all ingredients. Monosaccharides or disaccharides like sucrose or fermentable carbohydrates are not found in toothpaste

g. **PH :**

The herbal substance was mixed thoroughly with deionized water to create a suspension. Then used a Jenway 3510 pH metre to measure the pH⁽¹⁾.



Figure No. 3. PH Meter

CONCLUSION:

Teeth are the stronger and hardest part of the human body, maintaining good oral hygiene is crucial. To keep our mouths clean and free of microorganisms, we use toothpaste on a daily basis. Given that herbs have a wide range of medicinal characteristics for a wide range of illnesses, the current review includes a variety of herbs utilised in the manufacture of dentifrices. Herbal toothpaste is thought to be generally safe, easily accessible, and have comparable anti-microbial and good abrasive properties to conventional toothpaste. The use of herbal toothpaste is essential in the management of a number of dental conditions, including gingivitis, caries, and plaque. Therefore, it is determined that it is necessary to identify and elucidate the structure of the bio active components responsible for the antibacterial activity against various microbes.

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