

HERBCRAFT: BOON TO THE PERIODONTAL THERAPY

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ABSTRACT:

There are various natural ways to treat and manage periodontal disease, some of which also help in preventing the occurrence of these diseases. Copious herbal products and their extracts such as aloe vera, green tea, eucalyptus, propolis, etc., have shown significant results. Our aim is to present an overall view of the diverse strategies adopted currently for the formulation and application of traditional herbal remedies in the treatment of periodontal diseases as an adjunct to the non-surgical therapy. The paper provides a review of potent herbal remedies being used worldwide. Clinical trials for assessment of safety and efficacy of these herbal remedies are in their infant stage. These herbal remedies hold a promising future in periodontal therapy.

Key words: Herbal remedies, Periodontal diseases, Non-surgical therapy.



INTRODUCTION:

The word "periodontitis" comes from *peri* ("around"), *odont* ("tooth") and *-itis* ("inflammation"). It is an inflammatory disease of the supporting tissues of the teeth caused by specific microorganisms or groups of specific microorganisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with pocket formation, recession, or both. ^[1] Although advanced stages of

periodontitis require surgical treatment, natural remedies may be used to halt or reverse the progression of the disease in its initial stages. Recent development of science and technology has revolutionized the basic outlook and approach to the problems of periodontal disease. Earlier it was assumed that periodontal problems were invariably progressive and the morbid effects increase with passage of time. A thorough understanding of the

etiopathogenesis of periodontal disease has provided the clinicians and researchers with a number of diagnostic tools and technique that has widened the treatment options.

A herb is any plant that lacks the woody tissue characteristic of shrubs or trees. Herbs with medicinal properties are useful and effective source of treatment for various disease processes. Many allopathic medicine-have their origin in medicinal plants. Use of alternative therapies is common among patients with serious, chronic, or degenerative illness and to combat side effects with allopathic medicine and surgical treatments. Herbal preparations can be derived from the root, leaves, seeds, and flowers. The preparations often contain a concoction of chemical substances containing minerals and vitamins, and determining a specific active ingredient.^[2] This paper includes few herbs which can be used as an adjunct in periodontal therapy.

GREEN TEA:

Green tea is one of the most popular beverages in the world, and it has received considerable attention because of its many scientifically proven beneficial effects on human health.^[3] The tea plant is believed to have originated in the landmass encompassing Tibet, western China and northern India. According to ancient Chinese legend, tea was discovered by the Chinese emperor Shen-Nung in 2737 BC, when leaves from a wild tea bush accidentally fell into a pot of water that he was boiling. The drink name derives from the Chinese Amoy dialect word “t’e,” pronounced “tay,” which has developed into a fine art. Today, “cha” means tea in Chinese. As

this word moved westward into the Middle Eastern languages, it sometimes became altered to “chai.”^[3]

India attributes the discovery of tea to the Buddhist monk Siddhartha in the 6th century. Inspired by divine intervention, he picked and chewed the leaves of a nearby tree, discovering, to his delight, a great sense of alertness and well being. The tree whose health-giving properties enabled him to keep his vow was, of course, *Camellia sinensis*.^[3]

Green tea is extracted from the leaves of *Camellia sinensis*, which is shrub-like, plant grown in a semi tropical environment on plantations in Southeast Asia. Heavy rainfall of 3000–7000 ft elevation is required. It is cloned or grown from seed from cuttings obtained from the mother bush and rooted and grown in a nursery for 1 or 2 years. Green tea is grown in rows or on terraces.^[4]

Tea leaves are picked three to four times between spring and fall of each year. Green tea is produced from leaves that are picked and heated quickly, either in a pan or with hot steam, to stop enzymatic action and to prevent fermentation. Fermentation involves air oxidation and polymerization of tea components including polyphenolic catechins that are major constituents of tea leaves.^[5]

Tea is reported to contain nearly 4000 bioactive compounds of which one third is contributed by polyphenols.^[6] Other compounds are alkaloids (caffeine, theophylline and theobromine), amino acids, carbohydrates, proteins, chlorophyll, volatile organic compounds (chemicals that readily produce vapors

and contribute to the odor of tea), fluoride, aluminum, minerals and trace elements.^[7] Polyphenols found in tea are mostly flavonoids and catechins.^[8] The catechins are thought to be responsible for the health benefits that have traditionally been attributed to tea, especially green tea.^[9] Major catechins are epicatechin gallate (ECG), epicatechin (EC), epigallocatechin (EGC) and epigallocatechin gallate (EGCG). The most active and abundant catechin in green tea is epigallocatechin-3-gallate (EGCG).^[5]

Green tea catechin inhibit the growth of *P. gingivalis*, *Prevotella intermedia* and *Prevotella nigrescens* and adherence of *P. gingivalis* on to human buccal epithelial cells.^[10]

Green tea catechins with steric structures of 3-galloyl radical, EGCG, ECg and galocatechin gallate, which are major tea polyphenols, inhibit production of toxic end metabolites of *P. gingivalis*. A study showed that green tea catechin, EGCG and ECG inhibit the activity of *P. gingivalis*-derived collagenase.^[11]

Green tea catechin showed a bactericidal effect against black-pigmented, Gram-negative anaerobic rods *Porphyromonas gingivalis* and *Prevotella* species, and the combined use of mechanical treatment and the application of green tea catechin using a slow-release local delivery system was effective in improving the periodontal status. The peptidase activities in the gingival fluid were maintained at lower levels during the experimental period in the test sites, while it reached 70% of that at baseline in the placebo sites.^[12]

EGCG inhibited osteoclast formation in a coculture of primary osteoclastic cells and bone marrow cells, and it induced apoptotic cell death of osteoclast-like multinucleated cells in a dose-dependent manner thus suggesting the role of green tea in the prevention of bone resorption.^[13]

Oxidative stress plays an important role in the pathogenesis of periodontal disease as well as many other disorders, and it is believed that antioxidants can defend against inflammatory diseases.^[14]

The principal components of bad breath are volatile sulfide compounds, especially hydrogen sulfide (H₂S), methyl mercaptan (CH₃SH) and dimethylsulfide {(CH₃)₂S}. These compounds result from the proteolytic degradation by predominantly anaerobic Gram negative oral microorganisms of various sulfur-containing substrates in food debris, saliva, blood and epithelial cells.^[15] Considering the role of periodontopathic bacteria in producing volatile sulfure compounds, antimicrobial polyphenoles in green tea can improve bad breath by suppressing these bacteria.^[16] The effect of tea catechins on methyl mercaptan (MSH), a main source of halitosis, has been studied.^[17]

Deodorant activity decreased in the following order: EGCG > EGC > ECG > EC. Chewing gum containing tea catechins significantly decreased MSH production from saliva containing L-methionine and apparently was useful in reducing bad breath. The deodorizing effect of EGCG involves a chemical reaction between EGCG and MSH. The reaction involves introduction of a methylthio and/or a methylsulfinyl group into the B ring of

EGCG. During this reaction, a methylthio group is added to the orthoquinone form of the catechin generated by oxidation with atmospheric oxygen and helps in reducing halitosis.^[18]

Most green tea products are sold as dried leaf tea. The best way to get the catechins and other flavonoids in tea is to drink it freshly brewed. The recommended consumption is three to four cups of tea a day. The average cup of green tea contains about 50–150 mg polyphenols. However, some research suggests that up to 10 cups per day is needed to receive enough polyphenols to notice a marked increase in health.

In one study, the author recorded the daily intake of green tea as number of cups, and found that every one cup/day increment in green tea intake was associated with a 0.023-mm decrease in the mean PD ($P<0.05$), a 0.028-mm decrease in the mean CAL ($P<0.05$) and a 0.63% decrease in the BOP ($P<0.05$).^[19]

ALOEVERA:

Aloe vera is a perennial succulent plant belonging to the Aloeaceae family (subfamily of the Asphodelaceae).^[20] Among >400 aloe species, aloe vera is the most accepted species for various medical, cosmetic, and nutraceutical purposes.^[21]

Aloe vera has anti-inflammatory properties,^[22-24] antiulcer activity,^[25, 26] and an astringent effect and may have the ability to reduce scars and enhance wound healing.^[27-30] The aloe vera plant contains anthraquinone glycosides (especially in the latex form, which is different from the gel), polysaccharides, aloeresins, glucomannans, and b-

sitosterol.^[31] Antioxidative phenolic compounds were recently isolated from *Aloe barbadensis* and identified as aloeresin derivatives.^[32] These properties, along with the ease of availability, no known adverse effects, and cost effectiveness, make aloe vera an ideal candidate for plaque control, thereby reducing gingivitis and most likely eventual periodontitis. The aloe vera gel contains various carbohydrate polymers, notably either glucomannans or peptic acid, along with a range of other organic and inorganic components.^[33]

Treatment of inflammation is still the key effect for most types of healing, and immunomodulatory properties of the gel polysaccharides, especially the acetylated mannans from aloe vera, seem to play a key role. Antidiabetic, anticancer, and antibiotic activities of aloe vera have also been reported, indicating wider use of this gel.^[31]

Saito et al. proposed that a glycoprotein, aloctin A, which was isolated from *Aloe arborescens*, markedly inhibits arthritis in rats and carrageenan-induced edema in rats.^[34] Hutter et al. identified an anti-inflammatory agent as C-glucosyl chromone from *Aloe barbadensis*. Aloe vera is known to contain several active ingredients, including a carboxypeptidase.^[35]

The antimicrobial effect of a dentifrice containing aloe vera has been demonstrated in an in vitro study in which this phytotherapeutic agent inhibited the growth of diverse oral microorganisms, such as *Streptococcus mutans*, *Streptococcus sanguis*, *Actinomyces viscosus*, and *Candida albicans*.^[30]

Villalobos et al observed a significant reduction in plaque and gingivitis after a 30-day use of mouthrinse containing aloe vera with toothbrushing.^[36] de Oliveira et al found out that both dentifrice containing aloe vera and fluoride resulted in significant reduction of plaque and gingivitis, but no statistical significant difference was observed between them that inactivates bradykinin in vitro, salicylates, and a substance that inhibits thromboxane formation.^[37]

The production of reactive oxygen species (ROS) is an essential protective mechanism against diseases associated with phagocytic infiltration as the host defense against bacterial pathogens.^[38] Reactive oxygen species not only play an important role in cell signaling and metabolic processes but are also thought to be implicated in the pathogenesis of a variety of inflammatory disorders.^[39] A defined role for reactive oxygen species in the tissue destruction that characterizes periodontitis has been described.^[40]

Okyar et al. reported that aloe vera leaf pulp extract was effective in reducing blood sugar, suggesting that it might be useful in the scavenging of free radicals.^[41] It was reported that treatment with aloe vera increased antioxidant enzymes and significantly reduced lipid peroxidation products in streptozotocin-induced diabetic rats, showing the relationship between antioxidant activity and the onset of diabetes.^[42-44]

The aloe vera extract treatment has also resulted in a significant increase in reduced glutathione, superoxide dismutase, catalase, glutathione peroxidase, and glutathione S-transferase in the liver and kidney of

diabetic rats, showing the antioxidant property of aloe vera gel extract.^[42] Thus, it can be hypothesized that aloe vera extracts can be useful in the control and treatment of periodontal diseases by virtue of their antioxidant properties as well.

EUCALYPTUS:

Eucalyptus is a native to Australia and is a widely planted genus. Eucalyptus globulus is a representative of Eucalyptus species. Its leaf is used for medicinal purposes and as a food source, e.g., tea, natural additives, and health foods. Ethanol extracts [60% ethanol] from E. globulus leaves reportedly possess antibacterial activity against various bacteria, including oral bacteria.^[45-49]

The extracts exhibit potent anti-bacterial activity against cariogenic bacteria, such as *Streptococcus mutans* and *Streptococcus sobrinus*; additionally, the extracts inhibit insoluble glucan synthesis by extracellular glucosyltransferase from *S. sobrinus*.^[48] Moreover, 60% ethanol extracts from the E. globulus leaf displayed antibacterial activity against several periodontopathic bacteria, including *Porphyromonas gingivalis* and *Prevotella intermedia*. Among periodontal bacteria, the growth of *P. gingivalis* was strongly inhibited even with a low concentration (10 mg/ml) of eucalyptus extracts.^[50]

Macrocarpals, are polyphenols which are unique to eucalyptus and are major components of ethanol extracts of E. globulus leaf; furthermore, these compounds exhibit several interesting biologic properties, such as antibacterial and antiviral activities,^[51] antagonism of thromboxane A2 and leukotriene D4,^[52]

human immunodeficiency virus–reverse transcriptase inhibition [53,54] and aldose reductase inhibition.^[55]

Macrocarpals A, B, C, D, H, I, and J and eucalypton were isolated in the mid-1990s.^[47, 48, 56] Macrocarpals A, B, and C, which are major components, demonstrate relatively strong anticariogenic bacterial activity against *S. mutans* and *S. sobrinus* and inhibit glucosyltransferase produced by *S. sobrinus*.^[48] Additionally, macrocarpals A, B, and C possess antiperiodontopathic bacterial activity against several periodontopathic microorganisms, e.g., *P. gingivalis*. Macrocarpal C occurs in the greatest abundance in eucalyptus extract, and it exhibits the strongest antibacterial activity against periodontopathic bacteria. Moreover, macrocarpals A, B, and C inhibit the activity of virulence factors of *P. gingivalis*, including Arg- and Lys-specific cysteine proteinases, as well as adhesion of the organism to saliva-coated hydroxyapatite beads. Therefore, in ethanol extracts of eucalyptus leaf, macrocarpals A, B, and C [macrocarpal C in particular] are considered the primary antibacterial agents against cariogenic and periodontopathic bacteria.^[49]

PROPOLIS:

Propolis, also called as bee glue, is a natural resinous substance collected by honey bees (*Apis mellifera* L.) from plant buds and bark exudates and mixed with other substances. Propolis is used as a sealant for unwanted open spaces in the hive. Propolis is a very complex mixture and its chemical constituents vary according to its source. A broad analysis reveals approximately 55% resinous compounds and balsam, 30% beeswax,

10% ethereal and aromatic oils, and 5% bee pollen. Bioflavonols are the key contributors to propolis' properties. According to a research undertaken at the Second Leningrad Scientific Conference on the Application of Apiculture (bee culture) in Medicine, bee propolis was found to be rich in vitamins A, B1, B2, B3, biotin and 14 of the 15 minerals that the human body requires for normal function. It also contains a number of unidentified compounds that work together synergistically to create a balanced nutritive substance.^[57]

It is commonly brown in colour, but it varies depending on the botanical source. Flavonoids are well known plant compounds which have antibacterial, antifungal, antiviral, antioxidant, and anti-inflammatory properties. Flavonoids are the most common group of polyphenolic compounds in the human diet and are found ubiquitously in plants. They are divided into four subgroups: Flavones, Flavonol, Flavonones and Flavononol. Cinnamic acid is a white crystalline acid, which is slightly soluble in water and is obtained from oil of cinnamon, or from balsams. In biological chemistry, cinnamic acid is a key intermediate in phenyl-propanoid pathway. Phenyl-propanoid are a class of plant metabolites based on phenylalanine.^[58]

Propolis has been found to be very effective against gram positive and gram negative bacteria. It is one of many most sterile substances of the animal kingdom. Propolis is found to have strong inhibitory effects on at least 21 species of bacteria, 9 species of fungi, 3 species of protozoa, and a wide range of viruses.^[59]

Commercial preparations of propolis appear to retain antibiotic properties. Murray investigated the effectiveness of a propolis containing mouthrinse in the inhibition of plaque formation concluded that propolis containing mouthrinse was marginally better than negative control.^[60]

Mahmoud et al concluded that the effect of propolis on dentinal hypersensitivity and reported that propolis has a positive effect in the control of dentinal hypersensitivity.^[61]

NEEM:

The first known use of Neem was in Harrappa culture in ancient India which dates 4500 years back. The history of the Neem tree is inextricably linked to the history of the Indian way of life. Neem extracts are used to treat various skin diseases, as an antiseptic substance, against endoparasites and ectoparasites or simply as a herbal mouthwash.^[62] Most of the work on Neem has been done in laboratories because treating bacteria is relatively straight-forward there. In test tubes, Neem has been shown to have significant effects on both gram-positive and gram-negative organisms and other bacteria that cause a wide array of human and animal diseases including *E. coli*, streptococcus and salmonella.^[63]

Wolinsky et al have examined the inhibitory effects of aqueous extracts of Neem, derived from Neem stick upon bacterial aggregation, growth, adhesion to hydroxyapatite, and production of insoluble glucan, which may affect in vitro plaque formation. The Neem stick extract and the gallotannin-enriched extract from *Melaphis chinensis* inhibited

insoluble glucan synthesis. Incubation of oral streptococci with the Neem stick extract resulted in a microscopically observable bacterial aggregation. This data suggest that Neem stick extract can reduce the ability of some streptococci to colonize on tooth surfaces. It also provides a good efficacy in the treatment of periodontal diseases.^[64]

In a small trial, it was suggested that a dental gel containing Neem extract has significantly reduced plaque index and bacterial count as compared to positive controls (chlorhexidine 0.2%). *Streptococcus mutans* found in the saliva was found to be reduced significantly.^[65]

TEA TREE OIL:

Tea tree oil is derived from the paper bark tea tree, which is part of the family Myrtaceae. It belongs to two genera, *Leptospermum* and *Melaleuca*. Tea tree oil is the essential oil containing many components, the majority being monoterpene and sesquiterpene hydrocarbons and their alcohols. The antibacterial properties of tea tree oil have now been well documented, and there are susceptibility data on a wide range of bacteria.^[66] It contains 2.6% Cineole and 41.7 % Terpinen-4-ol. The main chemical components of tea tree oil are α -pinene, β -pinene, sabinene, myrcene, α -phellandrene, α -terpinene, limonene, 1, 8-cineole, γ -terpinene, p-cymene, terpinolene, linalool, terpinen-4-ol and a-terpineol.^[67]

Australian Aborigines have used plant-derived medications including Tea tree oil. These preparations are used both internally and externally for the alleviation of pain and the promotion of healing.^[68] Tea tree oil is used by

Aborigines to treat abrasions, cuts, colds and influenza. Tea tree oil is now used around the world in many cosmetic, medicinal and dental products (e.g., natural toothpastes). The main components of tea tree oil are also found in other common essential oils, e.g., eucalyptus and fennel oil. 1, 8-cineole has anti-inflammatory properties, and is able to penetrate human skin.^[69-72] Terpinen-4-ol has similar anti-inflammatory activities as 1, 8-cineole^[73, 74] but also has anti-bacterial activity.^[75-79]

Tea tree oil shares a similar range of antimicrobial activity with chlorhexidine (CHX), although their mechanisms of action differ. They both have antibacterial, antiviral and antifungal properties.^[76, 79-85] Tea tree oil has the potential to be a therapeutic agent in chronic gingivitis and periodontitis, conditions that have both bacterial and inflammatory components. Mouthwashes containing tea tree oil reduce gingival inflammation. It also helps in controlling halitosis and plaque formation.^[86]

TULSI:

Tulsi in Sanskrit means “one that is incompatible or matchless”. Botanical name is *Ocimum sanctum*, Tulsi was recognized thousands of years ago as one of the India’s greatest healing herb. Tulsi was then established as one of the eight indispensable items in any Vedic worship. It is found almost in every house in India and is readily found now even in the West and therefore one of its names is Sulabha ‘the easy obtainable on’.^[87]

It is an erect soft, hairy aromatic herb or undershrub found throughout India. It is

commonly cultivated in gardens. Two types of *Ocimum sanctum* are met within cultivation: (i) Tulsi plants with green leaves known as ‘Rama or Shri Tulsi’ and (ii) Tulsi plant with purple leaves known as ‘Shama or Krishna Tulsi’. Both of these are used as medicinal plants for various ailments.^[88]

Several medicinal properties have been attributed to *Ocimum sanctum*. Different parts e.g. leaves, flowers, stem, root, seeds etc. are known to possess therapeutic potentials and have used by traditional medicinal practitioners as expectorant, analgesic, anti-cancer, anti-asthmatic, antiemetic, diaphoretic, anti-diabetic, hepato-protective, hypotensive, hypolipidemic and antistress agents. Tulsi has also been used in the treatment of fever, bronchitis, arthritis, convulsions etc.^[89]

Tulsi leaves dried in sun and powdered can be used for brushing teeth.^[90] It can also be mixed with mustard oil to make a paste and used as toothpaste. Tulsi has also proven to be very effective in counteracting halitosis. Its anti-inflammatory property makes it a suitable remedy for gingivitis and periodontitis, and it can be used for massaging the gingival in these conditions.^[91]

TURMERIC:

Turmeric is perennial plant with orange, oblong tubers. When dried; it is made into a yellow powder with a bitter, slightly acrid, yet sweet taste. Turmeric has range of therapeutic actions like antioxidant, anti-inflammatory and anti-mutagenic, analgesic, antibacterial, anti-tumor, anti-allergic, antiseptic, antispasmodic, appetizer, astringent,

carminative, cholagogue, digestive, and diuretic. The active constituent of turmeric is known as curcumin. Turmeric can be used in relief from pain and bleeding of gingival in gingivitis and periodontitis.^[92]

Chemo-preventive activity of curcumin is observed when it is administered prior to, during, and after carcinogen treatment as well as when it is given only during the promotion/progression phase of colon carcinogenesis.^[93] Turmeric mouth rinse (prepared by boiling 5gm of turmeric powder, two cloves, and two dried leaves of guava in 200gm water) and its paste form (turmeric, salt and mustard oil) can be used for the treatment gingivitis and periodontitis.^[94]

OTHERS:

Many other herbs are also being used in various forms (mouthwashes, toothpastes, local drug delivery etc) in treatment of periodontal diseases. **Bloodroot** can curb the growth of periodontopathogens. It is included in oral health products such as toothpaste and mouthwashes.^[95] Anti-inflammatory and antibacterial properties, **chamomile** can help soothe inflammation in periodontitis and reduce the levels of pathogenic microorganism. It comes in form of tea, mouthwashes and tooth paste.^[96] Unique **cranberry** juice component, a high molecular- weight nondialysable material (NDM), has the ability to reverse and inhibit the co-aggregation of certain oral bacteria responsible for dental plaque and periodontal disease.^[97] Non-cytotoxic **blackberry** extract concentrations exhibit antimicrobial properties against important periodontal pathogens as well as *Streptococcus mutans*. It has the

potential to be used as an antibacterial topical agent for the prevention and control of periodontitis as well as dental caries. Incorporation of blackberry extract in oral- release devices, such as chewing gum, is a long-term goal.^[98]

CONCLUSION:

Though a vast number of plants have not been studied for their medicinal properties, these may become new sources of medicinal activity. It is believed that the plants (traditional medicine) will be a major source of new chemicals and raw materials for the pharmaceutical industry in near future.

It is important to carefully correlate the disease description in the ancient literature with the modern etiology and clinical picture to ensure correct correspondence. As traditional plant preparations have significant historical background, it may be ethical to clinically evaluate these first and then collect modern toxicological data. Important classes of compounds essential for biologic activity must be delineated. All of this knowledge will be essential for proper standardization of a product.

Therapeutic approaches with herbal medicine are often staggered due to lack of data on safety and efficacy and meticulous clinical trial evidence. It is recommended that more researches should be undertaken.

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TABLES:

TABLE 1: HERBS WITH THEIR USE IN PERIODONTAL PRACTICE

Plant	Generic name	Useful parts	Active constituents	Properties
Aloe	<i>Aloe barbadensis</i>	Leaves	Antraquinone	Anti-inflammatory
Amla	<i>Emblica officinalis</i>	Fruits	Vitamin C	Antioxidant
Babool	<i>Acacia arabica</i>	Bark	Tannins	Astringent
Blackberry	<i>Rubus fruticosus</i>	Leaves, root	Tannins	Astringent
Bloodroot	<i>Sanguinaria canadensis</i>	Root	Alkaloids (primarily sanguinarine)	Astringent
Blueberry	<i>Vaccinium myrtillus</i>	Ripe berries	Anthocyanosides	Antioxidant
Caraway	<i>Carum carvi</i>	Dried ripe fruit, dried seeds	Volatile oil	Anti-inflammatory
Chamomile	<i>Matricaria chamomilla</i>	Dried flowers	Volatile oils, biflavonoids	Anti-inflammatory
Clove	<i>Syzygium aromaticum</i>	Flower buds	Volatile oil, tannins	Antiseptic, analgesic
Cranberry	<i>Vaccinium macrocarpon</i>	Fruits	Flavonoids, triterpenoids	Antioxidant
Echinacea	<i>Echinacea purpurea</i>	Root	Alkylarnides	Immune system stimulant, increases interferon production
Eucalyptus	<i>Eucalyptus globosus</i>	Leaves	Volatile oil	Anti-inflammatory
Green tea	<i>Camellia sinensis</i>	Leaves	Polyphenols	Antibacterial
Horsetail	<i>Equisetum arvense</i>	Stem	Silicic acid and silicates, K, Al, Mn, Biflavonoids	Antibacterial
Liquorice	<i>Glycyrrhiza glabra</i>	Root	Glycyrrhizin, flavonoids	Anti-inflammatory, antioxidant
Miswak	<i>Salvadora persica</i>	Bark, leaves	Tannins, volatile oils, alkaloids	Anti-inflammatory
Moringa	<i>Moringa oleifera</i>	Leaves, stem, roots	Carotenoids, vitamin C	Anti-inflammatory, antibacterial, astringent
Mulberry	<i>Morus alba</i>	Fruits	Anthocyanosides	Antioxidant
Mynth	<i>Commiphora molmol</i>	Stem	Resin, gum, volatile oil	Antibacterial, astringent, analgesic, anticancer
Neem	<i>Azadirachta indica</i>	Leaves	Terpenoids	Antioxidant, anti-inflammatory, antibacterial
Peppermint	<i>Mentha piperita</i>	Leaves	Volatile oil containing menthol	Analgesic, counterirritant
Propolis	-	Resin itself	Flavonoids	Antibacterial, antioxidant, anticancer
Raspberry	<i>Rubus idæus</i>	Leaves	Tannins	Astringent, anti-inflammatory
Rhatary	<i>Krameria triandra</i>	Root-bark	Tannic acid	Astringent
Rose	<i>Rosa canina</i>	Hips, leaves, flowers	Vitamin C, flavonoids, tannins, carotenoids, volatile oils	Antibacterial, antioxidant, astringent
Sage	<i>Salvia officinalis</i>	Leaves	Essential oil constituents	Antioxidant
Stinging nettle	<i>Urtica dioica</i>	Root, leaves	Polysaccharides, lectins	Anti-inflammatory
Tormentil	<i>Potentilla erecta</i>	Dried rhizomes (roots)	Tannins	Anti-inflammatory
Tulsi	<i>Ocimum sanctum</i>	Leaves	Ursolic acid, apigenin, luteolin	Anti-inflammatory
Turneric	<i>Curcuma longa</i>	Dried rhizomes (roots)	Tannins	Analgesic, anti-inflammatory