

REVIEW ARTICLE

Medicinal Plants Useful to Cure Oral Diseases: A Review

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ABSTRACT

Oral disease is characterized by the damage of function which is a very sensitive among various other infections. In addition, oral diseases are spreading rapidly due to anthropogenic activities in recent days. Early diagnosis and detection of these diseases is crucial for effective treatment and positive outcomes. Regular checkups and screenings can aid in the early detection of the various diseases including cancer. The treatment for different diseases is a continuous process through various therapeutic agents including naturally available compounds from different medicinal plants. Moreover, man's dependence on plants for the treatment of various diseases has been well established. After basic necessities, mankind has also used medicinal plants in an attempt to cure oral diseases and relieve physical suffering. In general, cloves, turmeric, neem, tulsi etc., are useful to cure different oral diseases proved by various researchers. Though advanced biomedical tools are available at present, using of medicinal plants is cost-effective. Therefore, this review is intended to summarize the various medicinal plants and their compounds used to cure different oral diseases. This knowledge will be helpful to classify the medicinal plants and their chemical compounds which are useful to cure different oral diseases.

Keywords: Medicinal plants, Oral diseases, Neem, Tulsi, Turmeric, Treatment.

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INTRODUCTION

Role of medicinal plants on human life is enormous which are helpful to cure various diseases since ancient days. Primitive people in all ages had some knowledge of these medicinal plants, derived as a result of trial and error. A portion of the world's population still depends almost exclusively on medicinal plants. In addition, world health organization (WHO) emphasized that people in developing countries are still relies on traditional plant-derived drugs due to their low price without many side effects [1, 2]. Since ancient days, the Chinese, Greeks, Romans, Indians including certain parts of the world used the natural vegetation as medicine and have given voluminous information of the drugs. They wrote extensively about medicinal plants, giving their names, putative healing properties and also complex descriptions for the interpretation of medicines [3]. In India, earliest authors had sufficient knowledge of the properties of the Indigenous medicinal plants. The Ayurvedic systems of medicine have been in use for over three thousand years. The medicinal works studied by several researchers globally are esteemed even to this day as the treasures of literature on medicine [4].

Plants contain some complex chemical compounds which may not be possible to synthesize in a laboratory, provides important clues for new medicines. Different species of plants have been reported to be used for medicinal purposes in the various systems of medicine. Due to the importance of naturally available drug sources, the market potential for medicinal plants have high demand in recent times [5]. Though numbers of medicinal plants are available, only a few medicinal plants have high medicinal and economic value. Hence,

certain countries have been important exporters of medicinal plants. The majority of plants used for medicines are collected from the wild [6]. In general, the plant medicines are sold in the form of powders and crude extracts of roots, stems and leaves. In many cases, the medicinal herbs have been subjected to rigorous chemical analysis and efficiency of the drugs was evaluated. Based on the results, the bio-active components have been isolated and commercialized. In this process, new drugs have been discovered and novel potential medicinal values have been identified [7]. All these kind of demands necessitated the large scale collection of plants by collectors to supply raw material to industry. Several indigenous drug industries have been established in recent past which supply readymade medicines for use or partially processed raw material for the preparation of prescriptions.

Oral diseases and disorders limit the capacity of intake of water, food, function, psychosocial well-being etc. A number of factors including microorganisms such as bacteria, viruses, fungi etc., are disrupting the oral health to cause diseases [8]. Also, abiotic reasons such as temperature, pH, salinity etc., will causes temporary disorders. Most of the oral diseases are sensitive and painful and oral cancer is life threatening when compared to other disorders. Early precautionary measures and treatment may prevent some of these diseases. To date, people are severely phasing the disorders in sensitive parts such as oral due to lack of awareness [9]. Based on place and causative agents, there are many classifications of oral diseases. At present, we are mainly focusing on most common oral or dental diseases and their causative agents. Dental caries, gingivitis, oral herpes, periodontal disease, oro-dental trauma, dental discoloration (stains), cleft lip and palate, oral manifestations to HIV, oral sensitivity to temperature, oral cancer etc., are the examples of oral diseases. Figure 1 illustrates about various oral and dental diseases.

Gingivitis is a common gum disease caused by certain bacteria and food debris [10]. Periodontal disease is an upgradation stage of gingivitis which causes damage to soft tissues surrounding the teeth [3]. Dental caries is another common disease caused by *Streptococcus mutans* and food debris. Caries is characterized by demineralization of the inorganic and destruction of the organic substance of the tooth [11]. Oral herpes is a painful blister disease caused by herpes simplex virus (HSV-1 and HSV-2) [12]. Dental hypersensitivity is a condition characterized by a sharp and sudden pain in response to chemical and thermal stimuli. Tooth discoloration (stains) is caused by food, smoking, beverages, poor oral hygiene etc. [13]. Oro-dental trauma is happened as a result of external and internal forces i.e. accidents, injuries, bruxism etc. Cleft lip and palate is a birth defect which is not common and damages the facial structure. Oral wart, hairy leukoplakia, oral thrush, canker sores and gum disease are the common symptoms of oral manifestation of HIV. Oral cancer is one of the dangerous diseases caused by several etiological factors [14]. Cancer affects the inside and outside of the mouth and causes white patches or sores that bleed.

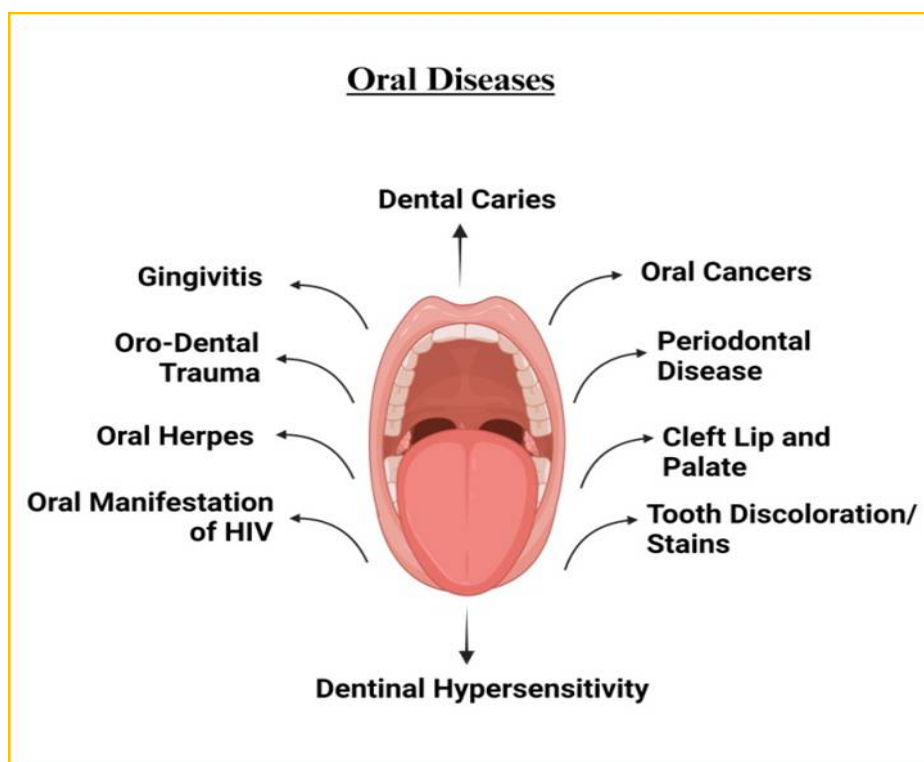


Figure 1. List of various oral diseases.

Apart from the discovery, authentication and mechanism of action of plant-based drug is an important issue to control the oral diseases. The integrated approach of both conventional and molecular researchers will give better results for the validation of plant-based drugs. Moreover, understanding the plant-based drug nature to mitigate the disease outbreak is a continuous process. With this background and to continue this kind of research, information of medicinal plants to control oral diseases is an important topic for present and future applications. The current information may be helpful to mitigate certain oral-related problems.

Medicinal plants used to cure various oral diseases

Man's dependence on plants specifically for medicinal purpose is began centuries back and the same tradition again came into serious practice due to cost effective and easy availability in nature. In addition, serious usage of modern synthetic drugs lead to side effects and the life of synthetic drugs are limited and expire quickly than naturally available plant-based drugs. Table-1 explains about involvement of various medicinal plants to cure different oral diseases. Hwang et al. [15] used methanolic extracts of *Glycyrrhiza glabra*, *Physalis angulata*, *Kaempferia pandurata*, *Quercus infectoria* and *Baeckea frutescens* against anticariogenic effects caused by *S. mutans*. Particularly, first three showed fast effect against the bacterium. Fani et al. [16] proved that the extracts of garlic (*Allium sativum*) showed the antibacterial effect against multi drug resistant (MDR) *S. mutans*. Curcumin, a product of *Curcumin longa* inhibited the growth of Herpes simplex virus as per the works by Kutluay et al. [17]. *Azadirachta indica* (Neem) oil inhibits the growth of fungus, *Candida albicans* which causes tooth decay or oral infections [18]. *Camellia sinensis* (green tea) extracts exhibited the anti-Herpes simplex viral activity which is a causative agent of dental herpes [19]. Ghannad et al. [12] used aqueous *Glycyrrhiza glabra* extracts against Herpes simplex virus1 and proved that it has antiviral property. The extracts of Tulsi (*Ocimum sanctum*) act an antiproliferative agent and caused apoptosis in oral cancer cell lines [20]. The extracts of aswagandha (*Withania somnifera*) suppressed the growth of oral cancer cell lines [21].

Leaf extracts of green tea showed the growth inhibition of *S. mutans*, a major causative agent of caries [8]. Specifically, epigallocatechin-3-gallate-stearate (EGCG-S) of green tea is involved in bacterium growth inhibition and considered as good agent to avoid caries disease. Bassiri-Jahromi et al. [22] proved that peel extract of pomegranate (*Punica granatum*) worked against oral candidiasis because it acts as an alternative agent to Nystatin. Belobrov et al. [2] used the extract of *Camellia sinensis* (green tea) to cure oral cancer using H400 and H357 lines. Phytochemical extraction was carried out with *Myristica fragrans*, *Syzygium aromaticum*, *Punica granatum* and two types of *Morus alba* leaves using solvent maceration with ethanol, methanol and water [23]. The results proved that *Myristica fragrans*, *Syzygium aromaticum* and *Punica granatum* exhibited the effective antimicrobial activity against MDR *S. mutans*. Specifically, eugenol showed efficient antimicrobial activity against the *S. mutans*. Jalaluddin et al. [24] used *Curcuma longa* extracts against periodontal pathogens such as *Porphyromonas gingivalis*, *Prevotella intermedia* and *Aggregatibacter actinomycetemcomitans* and succeeded. They concluded that it has antibacterial activity against periodontopathic bacteria. Mandava et al. [11] tested anticaries effect against *S. mutans* using *Terminalia chebula*, *Psidium guajava*, *Azadirachta indica*, *Pongamia pinnata*, *Syzygium aromaticum* and *Mentha piperita* extracts. All the samples showed the inhibitory effect on *S. mutans* glucosyltransferases and higher inhibition was noticed with *Azadirachta indica* extract.

Binimiliz et al. [5] used *Elettaria cardamomum* ethanolic extract showed the antimicrobial activities against *Streptococcus mutans* and *Lactobacillus casei*. Wright and Altman [25] proved that Ginsenosides derived from *Panax ginseng* exhibited anti-Herpes simplex viral effects. Pourshahidi et al. [26] compared the effects of *Portulaca oleracea*, *Vaccinium myrtillus* and *Berberis vulgaris* extracts against oral squamous cell carcinoma cells. Bioactive components of garlic extract used to cure oral diseases by Sasi et al. [9]. Zhang et al. [27] proved that the [6]-Gingerol, the product of Zinger (*Zingiber officinale*) suppressed the growth of oral cancer cell lines. The extracts of *Myrtus communis* showed the antifungal activity against *Candida albicans* which is a causative agent of oral diseases [6]. The broccoli extracts exhibited the anticarcinogenic potential with oral cancer cell lines [14]. The antifungal activity of *Rosmarinus officinalis* was proved by Meccatti et al. [28] using *Candida albicans*. Very recently, Singh et al. [4] proved the role of Curcumin in anti-oral cancer activity. Rashid et al. [10] used extraction of *Cuminum cyminum* and *Foeniculum vulgare* which contain essential oils to check the growth of *Porphyromonas gingivalis* and *Prevotella intermedia*. Subgingival plaque samples were isolated from patients of severe periodontitis. They observed the antibacterial and antibiofilm activities against *P. gingivalis* and *P. intermedia*. In conclusion, several other medicinal plants also used to cure oral diseases which will be highlighted by various researchers.

Table 1. Medicinal plants used to cure oral diseases.

S/N	Medicinal plant name	Medicinal part	Bacterial Pathogens	References
1	<i>Glycyrrhiza glabra</i> , <i>Physalis angulata</i> , <i>Kaempferia pandurata</i> , <i>Quercus infectoria</i> and <i>Baeckea frutescens</i>	Leaf extract (Methanolic extract)	<i>S. mutans</i>	Hwang et al., 2004
2	<i>Allium sativum</i> (Garlic)	Bulb extract	<i>S. mutans</i>	Fani et al., 2007
3	<i>Curcuma longa</i> (Curcumin)	Rhizome	Herpes Simplex Virus 1 and 2	Kutluay et al., 2008
4	<i>Azadirachta indica</i> (Neem)	Leaves and seeds	<i>Candida albicans</i>	Mahmoud et al., 2011
5	<i>Glycyrrhiza glabra</i> (Licorice)	Aqueous root extract	Herpes simplex virus 1	Ghannad et al., 2014.
6	<i>Camellia sinensis</i> (Green tea)	Leaves and buds	Herpes Simplex Virus 1 and 2	Deepika et al., 2014
7	<i>Ocimum santum</i> (Holy basil)	Leaf extract	KB cell lines	Shivpuje et al., 2015
8	<i>Withania somnifera</i> (Ashwagandha)	Methanolic extract	MC3 and HN22 cells	Lee et al., 2016
9	<i>Punica granatum</i> (Pomegranate)	Peel and Seeds	<i>Candida albicans</i>	Bassiri-Jahromi et al., 2018
10	<i>Camellia sinensis</i>	Leaf extract Epigallocatechin-3-gallate-stearate (EGCG-S)	<i>S. mutans</i>	Melok et al., 2018
11	<i>Myristica fragrans</i> , <i>Syzygium aromaticum</i> , <i>Punica granatum</i> and two types of <i>Morus alba</i>	Seed, leaves and fruit peel	<i>S. mutans</i>	Chowdaiah et al., 2019
12	<i>Terminalia chebula</i> , <i>Psidium guajava</i> , <i>Azadirachta indica</i> , <i>Pongamia pinnata</i> , <i>Syzygium aromaticum</i> and <i>Mentha piperita</i>	Leaf extract and clove bud	<i>S. mutans</i>	Mandava et al., 2019
13	<i>Curcuma longa</i> (Turmeric)	Rhizome extract	<i>Porphyromonas gingivalis</i> , <i>Prevotella intermedia</i> , and <i>Aggregatibacter actinomycetemcomitans</i>	Jalaluddin et al., 2019
14	<i>Camellia sinensis</i>	Leaves and buds	Oral cancer cells (H400 and H357)	Belobrov et al. 2019
15	<i>Elettaria cardamomum</i> (Cardamom)	Seed extract	<i>S. mutans</i>	Binimiz et al., 2020
16	<i>Portulaca oleracea</i> , <i>Vaccinium myrtillus</i> and <i>Berberis vulgaris</i>	Fruit	SCC-15	Pourshahidi et al., 2021
17	<i>Allium sativum</i>	bulb	<i>Candida albicans</i>	Sasi et al., 2021
18	<i>Zingiber officinale</i> (Zinger)	Rhizome	YD10B cells	Zhang et al., 2021
19	<i>Myrtus Communis</i> (Myrtus)	Roots, Leaves, and Fruits	<i>Candida albicans</i>	Torabi et al., 2022
20	<i>Brassica oleracea</i> (Broccoli)	Florets	SSC9 Cell lines	Habba et al., 2022
21	<i>Rosmarinus officinalis</i> (Rosemary)	Leaves and stems	<i>Candida albicans</i>	Meccatti et al., 2022
22	<i>Foeniculum vulgare</i> (Fennel), <i>Cuminum cyminum</i> (Cumin),	Seed extracts	<i>Porphyromonas gingivalis</i> and <i>Prevotella intermedia</i>	Rashid et al., 2023
23	<i>Curcuma longa</i>	Rhizome	Human tongue squamous cancer cell lines and Human OSCC cell line	Singh et al. 2023

FUTURE PROSPECTS

In agriculture sector, conventional methods of medicinal crop cultivation is not that much practiced in entire world and it take years to get sufficient amount of material for commercial use. Moreover, certain developing or under developed countries are mainly looking for food crops than medicinal crop cultivation. The plant growth and development in the wild are completely depending on soil, seasons and weather conditions. Hence, they may not be available throughout the year for medicinal purpose as well any experimental

purpose. Therefore, using of advanced biotechnological methods such as tissue culture and genetic engineering may be useful to get plant drugs quickly. In addition, biodiversity specifically plants are more threatened today than at any other time in the past due to high pollution including other anthropogenic reasons. Also, there is a problem of extinction of certain endangered and endemic medicinal plants. Besides extinction, incorrect identification and adulteration of plant material are the several other serious problems of collecting medicinal plants from the wild. Hence, identification of medicinal plants is one of the biggest tasks and need to do several trail and errors for authentication with taxonomical experts. In addition, phytochemical research needs to be enhanced by both governmental and non-governmental organizations. At this juncture, the industries have a major role to play towards developing viable indigenous technologies to get plant-based drugs. An important consideration for any technology is the cost/benefit ratio. Overall, above aspects need to be considered for the improvement of phytochemical industries to cure various oral and other diseases.

CONCLUSIONS

Since olden days, man has started using plants as medicine and developed number of drugs for various diseases. Specifically, different plants were also used for oral diseases and dental cleaning purpose. In addition, several indigenous medicinal plants were identified to cure oral disease in most of the places in entire world. In this review, we emphasized the role of various plants used to cure oral diseases such as dental caries, oral herpes, oral cancer etc. Moreover, certain useful prospects were discussed to improve the phytochemical drug industries. The highlighted data in this review may be helpful to cure oral diseases and also for future research.

CONFLICT OF INTERESTS

Authors declared that there is no conflict of interest for this study.

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