

Medicated herbal chewing Gum to treat ulcers in mouth using Licorice and *Capsicum annuum*

Sanchit S. Gaikwad ^{1,*}, Manoj P. Jaybhaye ², Dipali R. Khandagale ³ and Prajakta S. Randive ³

¹ Professor, Bhalchandra Institute of Pharmacy, Pune, Maharashtra, India.

² Assistant Professor, Pharmacology, Bhalchandra Institute of Pharmacy, Pune, Maharashtra, India.

³ Assistant Professor, Pharmaceutics, Bhalchandra Institute of Pharmacy, Pune, Maharashtra, India.

World Journal of Biology Pharmacy and Health Sciences, 20(02), 270–277

Publication history: Received on 27 September 2024; revised on 08 November 2024; accepted on 11 November 2024

Article DOI: <https://doi.org/10.30574/wjbphs.2024.20.2.0868>

Abstract

This study explores the formulation and evaluation of herbal chewing gum containing extracts from Licorice (*Glycyrrhiza glabra*) and *Capsicum Annuum*, aimed at treating mouth ulcers. Licorice derived from roots. are known for their medicinal properties, it contains glycyrrhizin which is responsible for its sweet taste, including effects on sore throats, reduce inflammation and aid digestion. They contain various chemical compounds flavonoids such as such as liquirtin, rhamnoliquirilin, liquiritigenin, prenyllicoflavone A, glucoliquiritin apioside, methoxyphaseolin, shinpterocarpin, shinflavanone, licopyranocoumarin, glisoflavone, licoaryl coumarin, coumarin-GU-12 and saponins namely glycyrrhizin flavonoids. While *Capsicum annuum* is recognized for its anti-oxidant, analgesic, insecticidal and anti ulcer properties, containing phytochemicals like carotenoids, flavonoids, capsaicinoids, phenolic compounds, vitamins and minerals. The preparation of the herbal chewing gum involved incorporating these extracts along with other necessary ingredients. Triethanolamine was added to adjust the pH to a suitable range (6.7-7.2) for oral mucosa compatibility.

The study emphasizes that chewing gums serve as mobile drug delivery systems, allowing for the incorporation of herbal medicines for treating mouth ulcers. The convenience of chewing gum enables self-medication without the need for water, with active substances being released during chewing. This method facilitates local treatment of mouth diseases and systemic delivery through absorption via the buccal mucosa the herbal chewing gum represents an effective drug delivery system.

Keywords: Herbal medication; Licorice; *Capsicum Annuum*; Environment compatible; Oral mucosa

1. Introduction

As human beings, we are constantly engaged in a battle against diseases, and nature has provided us with a variety of powerful tools to aid in this fight. In ancient times, we relied heavily on natural remedies to combat ailments. However, as time progressed, we developed the ability to synthesize drugs, creating our own arsenal against illnesses. While synthetic drugs have gained popularity over the years, there are still certain areas where natural drugs are favored over their synthetic counterparts. One notable area is the development of antiulcer drugs.

Mouth Ulcer: An ulcer that forms on the mucous membrane of the oral cavity is referred to as a mouth ulcer, also known as an oral ulcer or a mucosal ulcer. These painful, round or oval sores typically appear on the inside of the cheeks (vitamin C), poor dental hygiene, infections, stress, indigestion, mechanical injuries, food allergies, hormonal imbalances, and skin conditions. Mouth ulcers, also known as aphthous ulcers, can be painful, especially when eating, drinking, or

* Corresponding author: Sanchit S. Gaikwad

brushing teeth. They result from the erosion or loss of the upper mucosal layer and are among the most frequently encountered pathological conditions of the oral cavity. These sores are typically painful and are most commonly found on the inner sides of the lips and cheeks.

The exact cause of stomatitis remains unclear, but various factors are believed to contribute to their development. These include different viruses, fungi, Treponema bacteria, autoimmune diseases, malnutrition, hormonal fluctuations, psychological stress, and other potential factors.

Mouth ulcers can be classified into three main types based on their size and quantity: minor, major, and herpetiform ulcers

These are usually small, measuring between 2 to 8 mm in diameter. They are the most common type and typically heal within 10 days to 2 weeks without leaving any scars

Major ulcers are larger and deeper, often with a raised or uneven border. Healing can take several weeks, and there is a possibility that they may leave a scar in the mouth.

These consist of a cluster of numerous tiny lesions, approximately the size of pinheads. They can be quite painful and may also take longer to heal compared to minor ulcers.

Each type of mouth ulcer has its own characteristics and healing times, and understanding these differences can help in managing symptoms and seeking appropriate treatment

Ulcerative conditions in the mouth, such as mouth ulcers, are quite common and can often be attributed to trauma. This trauma may come from factors like ill-fitting dentures, broken teeth, or dental fillings. While most mouth ulcers heal on their own, it is crucial to monitor their duration and characteristics.

If a mouth ulcer persists for more than three weeks, it is recommended that the patient undergo a biopsy or other diagnostic tests. This is important to rule out more serious conditions, including cancer or other severe disorders, such as chronic infections. Early detection and diagnosis are key to ensuring proper treatment and management of any underlying issues¹

- **Viral infections:** Certain viruses can lead to the formation of mouth ulcers.
- **Toothpastes and mouthwashes containing sodium lauryl sulfate:** This ingredient can irritate the mucous membranes in the mouth, leading to ulcers.
- **Mechanical trauma:** Injuries from dental work, biting the cheek, or other physical damage can cause ulcers.
- **Emotional stress / Psychic stress:** Stress can weaken the immune system and trigger ulcer formation.
- **Nutritional deficiencies:** Lack of essential nutrients, particularly vitamins B12, folate, and iron, can lead to ulcers.
- **Allergies and sensitivities:** Reactions to certain foods or substances can result in mouth ulcers.
- **Hormonal changes:** Fluctuations in hormones, such as during menstruation, can be associated with ulcer outbreaks.
- **Genetics:** A family history of mouth ulcers may increase the likelihood of developing them.
- **Infectious agents:** Both bacterial and viral infections can lead to the formation of ulcers.
- **Medical conditions:** Certain underlying medical conditions, such as autoimmune diseases, can also contribute to the occurrence of mouth ulcers or lips.²

Mouth ulcers are quite common and can arise from various conditions and factors, although they often occur without any significant underlying cause. Common triggers include nutritional deficiencies (like iron, vitamin B12, and vitamin C), poor dental hygiene, infections, stress, indigestion, mechanical injuries, food allergies, hormonal imbalances, and skin conditions. Mouth ulcers, also known as aphthous ulcers, can be painful, especially when eating, drinking, or brushing teeth. They result from the erosion or loss of the upper mucosal layer and are among the most frequently encountered pathological conditions of the oral cavity. These sores are typically painful and are most commonly found on the inner sides of the lips and cheeks.

The exact cause of stomatitis remains unclear, but various factors are believed to contribute to their development. These include different viruses, fungi, Treponema bacteria, autoimmune diseases, malnutrition, hormonal fluctuations, psychological stress, and other potential factors.

2. Mouth Ulcer types

Mouth ulcers can be classified into three main types based on their size and quantity: minor, major, and herpetiform ulcers.

- **Minor ulcers:** These are usually small, measuring between 2 to 8 mm in diameter. They are the most common type and typically heal within 10 days to 2 weeks without leaving any scars.
- **Major ulcers:** Major ulcers are larger and deeper, often with a raised or uneven border. Healing can take several weeks, and there is a possibility that they may leave a scar in the mouth.
- **Herpetiform ulcers:** These consist of a cluster of numerous tiny lesions, approximately the size of pinheads. They can be quite painful and may also take longer to heal compared to minor ulcers.

Each type of mouth ulcer has its own characteristics and healing times, and understanding these differences can help in managing symptoms and seeking appropriate treatment.

- **Cause of Ulcers:** - Ulcerative conditions in the mouth, such as mouth ulcers, are quite common and can often be attributed to trauma. This trauma may come from factors like ill-fitting dentures, broken teeth, or dental fillings. While most mouth ulcers heal on their own, it is crucial to monitor their duration and characteristics. If a mouth ulcer persists for more than three weeks, it is recommended that the patient undergo a biopsy or other diagnostic tests. This is important to rule out more serious conditions, including cancer or other severe disorders, such as chronic infections. Early detection and diagnosis are key to ensuring proper treatment and management of any underlying issues.³

3. Factors contribute to the development of mouth ulcers

- **Viral infections:** Certain viruses can lead to the formation of mouth ulcers.
- **Toothpastes and mouthwashes containing sodium lauryl sulfate:** This ingredient can irritate the mucous membranes in the mouth, leading to ulcers.
- **Mechanical trauma:** Injuries from dental work, biting the cheek, or other physical damage can cause ulcers.
- **Emotional stress / Psychic stress:** Stress can weaken the immune system and trigger ulcer formation.
- **Nutritional deficiencies:** Lack of essential nutrients, particularly vitamins B12, folate, and iron, can lead to ulcers.
- **Allergies and sensitivities:** Reactions to certain foods or substances can result in mouth ulcers.
- **Hormonal changes:** Fluctuations in hormones, such as during menstruation, can be associated with ulcer outbreaks.
- **Genetics:** A family history of mouth ulcers may increase the likelihood of developing them.
- **Infectious agents:** Both bacterial and viral infections can lead to the formation of ulcers.
- **Medical conditions:** Certain underlying medical conditions, such as autoimmune diseases, can also contribute to the occurrence of mouth ulcers.⁴

3.1. Herbal Remedies

Herbal remedies have been traditionally used by herbalists and indigenous healers for the prevention and treatment of mouth ulcers. Here's an overview of some commonly used medicinal herbs and their active ingredients that exhibit anti-ulcer properties:

- **Flavonoids:** These compounds have been recognized for their anti-inflammatory and antioxidant effects. Some examples include:
 - Quercetin
 - Naringin
 - Silymarin
 - Anthocyanosides
 - Soforadin derivatives
- **Saponins:** Found in plants like *Panax japonicus* and *Kochia scoparia*, these compounds can help reduce inflammation and promote healing.
- **Tannins:** Present in *Linderae umbellatae*, tannins have astringent properties that can help in healing ulcers.

- Gums and Mucus: Substances like guar gum and myrrh are known for their soothing properties and can provide relief from ulcers.
- Some specific medicinal herbs that are commonly used include:
- Licorice: Known for its anti-inflammatory and soothing properties, licorice can help alleviate ulcer pain and promote healing.
- Aloe gel: This natural remedy is well-known for its soothing and healing properties, making it effective for treating mouth ulcers.
- Capsicum (chili): While it may seem counterintuitive due to its spiciness, certain compounds in capsicum can help with pain relief and have anti-inflammatory effects. Various ethnomedical systems utilize different plant extracts for treating ulcers, showcasing the diversity and effectiveness of herbal medicine in managing this condition.

4. Herbs that can use as anti-ulcer drugs

Table 1 Herbs that can use as anti-ulcer drugs [5, 6]

Common Name	Botanical Name	Parts Used	Uses
Akarakara	<i>Pyrethrum D.C.</i>	Leaves, Roots, Fruits.	Restore Premature ejaculation, Antimicrobial, Anti-convulsant, Anti- Oxidant, Antipyretic.
Aloevera	<i>Aloebar badenis</i>	Leaves, flowers, Steams, seeds, Fruits.	Anlalgescic, antiseptic, Anti-inflammatory, Antioxidant, Antibacterial.
Turmeric	<i>Curcuma Longa</i>	Rhizome, steam	Anti-inflammatory, Anticancer effect, Cardiovascular disease, Antioxidant.
Papaya	<i>Carica papaya Linn</i>	Bark, leaves, fruit	Improve Digestion, Boosts immunity, Anti-Cancer Properties, anti- inflammatory.
Mint	<i>Mentha piperita</i>	leaves	Immunologic, Anti-inflammatory, Bad breath.
Tulsi	<i>Ocimum sanctum</i>	Leaves, Roots, Bark.	Hepatoprotective, Anticancer, Anti-ulcer, Anti- Fungal.

5. Benefits of herbal medicines

Medicinal herbs offer numerous benefits, making them a valuable resource in healthcare. some key advantages are:

- **Long History of Use:** Herbal medicines have been utilized for centuries, which contributes to their established safety and efficacy. This history fosters better patient tolerance and public acceptance compared to some synthetic medications.
- **Renewable Resource:** Medicinal plants are a sustainable source of healing compounds. This renewability allows for cheaper production of medicines, which is essential for meeting the needs of the growing world population.
- **Biodiversity:** Developing countries, like India, possess rich agroclimatic, cultural, and ethnic biodiversity. This diversity ensures a wide availability of various medicinal plants, enhancing the potential for discovering new therapeutic agents.
- **Organic Cultivation and Processing:** The cultivation and processing of medicinal herbs can often be done organically, minimizing the use of synthetic fertilizers and pesticides. This organic approach not only benefits the environment but also enhances the quality of the medicinal products⁷

6. Disadvantages of herbal medicines

Herbal medicines indeed have several disadvantages that should be considered:

- **Delayed Effects:** While herbal medicines can be beneficial, they often take longer to show effects compared to conventional drugs. This means that individuals who choose herbal remedies must be patient and may not experience immediate relief.
- **Self-Administration Risks:** Many herbal medicines are self-administered without professional guidance. As a result, there are often no standardized dosages or warnings provided. This can lead to misuse or overuse, especially if taken alongside prescription medications, potentially causing harmful interactions.
- **Risk of Toxicity:** Some plants used in herbal medicine can be toxic rather than healing. Certain parts of a plant may be safe to consume while others are poisonous. For example, rhubarb roots are used as a laxative, the stalks are edible, but the leaves are toxic. This presents a risk for those who may not be able to identify which parts of a plant are safe.
- **Identification Challenges:** Many individuals may lack the knowledge to accurately identify medicinal versus poisonous plants. This lack of awareness can lead to accidental poisoning, posing serious health risks.
- **Treatment:** Mouth ulcers are indeed capable of healing on their own within about two weeks, but medical treatments can offer significant relief. The primary functions of these treatments include numbing the pain, providing a protective barrier over the ulcer to prevent further irritation, and reducing the risk of bacterial infections. Additionally, certain medications can promote faster healing if applied early in the ulcer's development.

There are various forms of treatment available, such as paste treatments, gel treatments, mouthwashes, and liquid paint applications. These options help to neutralize the discomfort and create a more conducive environment for healing. By addressing both pain and protection, these treatments can greatly improve the overall experience for individuals suffering from mouth ulcers.⁹

7. Medicated Chewing Gum-10-12

Medicated chewing gums are indeed an innovative pharmaceutical dosage form that combines active pharmaceutical ingredients (APIs) with a gum base. These gums are designed to be chewed in the mouth for a specific duration, allowing the active ingredients to be released into the saliva. When chewed, the drug can either be absorbed through the oral mucosa directly into the bloodstream or travel to the stomach for gastrointestinal absorption. This dual pathway means that medicated chewing gums provide both local effects (in the mouth) and systemic effects (through the bloodstream)

7.1. History of chewing gum

History Chewing gums have indeed been utilized for cleaning and freshening purposes for centuries. The Mayan Indians, around 1000 years ago, chewed sapodilla tree resin to clean their teeth and freshen their breath.

The history of chewing gum development is less extensive compared to other dosage forms. The first commercially available chewing gum called "STATE OF MAINE PURE SPRUCE GUM" was launched in 1948 in the U.S.A. However, the first patent for chewing gum was filed in 1869 by Dr. William F. Semple, a dentist from Mount Vernon, Ohio. His patent (U.S. patent no. 98,304) involved a chewing gum made from Licorice and rubber dissolved in alcohol and naphtha, which he promoted as a dentifrice, viewing it as both a confectionery and a dental product. In 1924, the first medicated chewing gum, known as 'Aspergum', was introduced by Frank M. Dillard and William C. Nalle. They established the Dillard-Nalle company in December 1927 and sought trademark protection for Aspergum, which they began selling in 1928. This gum contained acetylsalicylic acid, an analgesic, as its active pharmaceutical ingredient. Chewing gum wasn't recognized as a drug delivery system until 1978, which came after the introduction of nicotine-containing chewing gum.

Additionally, in 1892, William Wrigley Jr. marketed his chewing gum product as 'LOTTA AND VASSAR'.¹³

7.2. Merits of MCG

- No need for water to swallow, so it can be taken anywhere.
- Provides accurate dosing of medication.
- Counteracts dry mouth, prevents candidiasis and caries.
- Highly acceptable by children due to its taste and appearance.
- Less first-pass metabolism leads to improved bioavailability of the active ingredients.

- The gum does not reach the stomach, minimizing the gastrointestinal effects of excipients.
- Reduces the risk of intolerance of the gastric mucosa by avoiding direct contact with high concentrations of active ingredients.
- Continuous delivery of the product to the stomach through saliva increases the duration of action.
- Treatment can be easily terminated at any time.
- Medications like Aspirin, Dimenhydrinate, and Caffeine show faster absorption through medicated chewing gum than traditional tablets.
- Stimulates saliva flow in the mouth, aiding in digestion and oral health.
- Neutralizes plaque acids that form in the mouth after consuming fermentable carbohydrates.
- Helps whiten teeth by reducing and preventing stains.

7.3. Demerits of MCG

Disadvantages of medicated chewing gum include:

- Prolonged chewing can cause pain in facial muscles and earache, especially in children.
- There is a risk of overdose compared to chewable tablets or lozenges, as it may be easier to consume more than intended.
- Sorbitol, which is often present in medicated chewing gum, can cause flatulence and diarrhea.
- Chewing gum may adhere to various degrees to dental enamel, dentures, and fillings, potentially causing issues.
- Additives like flavoring agents and cinnamon can lead to ulcers in the oral cavity, while Licorice can cause hypertension.
- Chlorhexidine, used for oromucosal application, has an unpleasant taste and staining properties on teeth and tongue, limiting its use to short-term applications.¹⁴⁻¹⁶

8. Liquorice

Known as *Glycyrrhiza glabra*, belongs to the Leguminosae family and is recognized for its expectorant and demulcent properties. It is particularly beneficial in alleviating pain and inflammation associated with stomatitis and mouth ulcers. When applied to these ulcers, licorice root extract can help reduce the size of the ulcers and promote faster healing. The licorice plant is a robust herb or undershrub that can grow up to 2 meters tall, featuring long, thick, multi-branched roots. The parts of the plant used for medicinal purposes are its roots and rhizomes. Notably, licorice contains a watersoluble, physiologically active complex that constitutes about 40-50 percent of its total dry weight. This complex includes various components such as triterpene saponins, flavonoids, polysaccharides, pectin, simple sugars, amino acids, mineral salts, and other substances. The sweet flavor of licorice root is mainly due to glycyrrhizin, a triterpenoid compound. Glycyrrhizic acid, which is a natural saponin, has a structure that includes a hydrophilic component, two molecules of glucuronic acid, and a hydrophobic fragment known as glycyrrhizic acid. The yellow color of licorice is attributed to its flavonoids, which include liquiritin, isoliquiritin (a chalcone), and other compounds. Additionally, glabridin and hispaglabridins A and B are isoflavones found in licorice that exhibit strong antioxidant properties, with both glabridin and glabrene showing estrogen-like activity. Clinically, *Glycyrrhiza* has demonstrated several pharmacological activities, including anti-ulcer, anti-asthmatic, anti-diuretic, and anti-hepatotoxic effects. This makes licorice a valuable herbal remedy for various health conditions.¹⁷⁻¹⁹

9. *Capsicum Annuum*

Capsicum Annuum, commonly known as bell pepper or sweet pepper, is a member of the Solanaceae family. It consists of dried fruits of *Capsicum Annuum* and smaller dried fruits of *Capsicum frutescens*. Morphologically, the individual flowers of *Capsicum Annuum* are whitish, sometimes appearing purple. The plant has densely branched stems that can grow up to 60 cm in height. The fruit is classified as a berry and can be green, yellow, orange, or red when it ripens. This species is adaptable to various frost-free climates but is particularly productive in temperate and dry climates.

The parts of the plant that are used are primarily the fruit. The chemical composition includes capsaicin, paprika oleoresin, and dihydrocapsaicin.

Capsicum Annuum, commonly known as bell pepper or sweet pepper, is a member of the Solanaceae family. It consists of dried fruits of *Capsicum Annuum* and smaller dried fruits of *Capsicum frutescens*.

Capsicum Annuum can be used in the treatment of mouth ulcers. The active compound, capsaicin, has anti-inflammatory and analgesic properties, which can help alleviate pain and discomfort associated with mouth ulcers.

Capsaicin works by desensitizing the nerve endings in the affected area, reducing pain signals sent to the brain. Additionally, the antimicrobial properties of *Capsicum Annuum* may help prevent infections in the ulcerated areas.

To use it for mouth ulcers, you can apply a topical ointment that contains capsaicin or consume products like paprika or hot peppers in moderation, depending on your tolerance. However, it's important to be cautious, as spicy foods can sometimes irritate the ulcers further. The parts of the plant that are used are primarily the fruit. The chemical composition includes capsaicin, paprika oleoresin, and dihydrocapsaicin.

Capsicum Annuum has several uses, including:

- As a spice: The sweet varieties are referred to as paprika, while the spicy varieties are known as hot peppers.
- For gastrointestinal disorders: It can help with symptoms such as abdominal bloating, upset stomach, cramps, stomach pain, and diarrhoea.
- For skin diseases: Due to its anti-irritant properties, it is used in ointments and patches to treat conditions like rheumatism, shingles, and lumbago.
- For neuropathy: It is utilized to relieve neuralgia associated with diabetes, HIV, fibromyalgia, and back pain.
- As a spice: The sweet varieties are referred to as paprika, while the spicy varieties are known as hot peppers.
- For gastrointestinal disorders: It can help with symptoms such as abdominal bloating, upset stomach, cramps, stomach pain, and diarrhoea.
- For skin diseases: Due to its anti-irritant properties, it is used in ointments and patches to treat conditions like rheumatism, shingles, and lumbago.
- For neuropathy: It is utilized to relieve neuralgia associated with diabetes, HIV, fibromyalgia, and back pain.²⁰⁻²¹

10. Conclusion

This review highlights the significant potential of naturally occurring constituents from medicinal herbs in addressing oral ulcers, regardless of their cause, and in preventing their recurrence. The healing properties of these herbs, coupled with their ability to enhance immunity, contribute to their holistic approach to treating the condition. Natural remedies are often preferred due to the perception that they are safer and associated with fewer side effects compared to synthetic medications. Consequently, there is a growing demand for herbal formulations in the global market. The proposal to develop an herbal chewing gum using guava leaf extract combined with turmeric rhizome extract is indeed a promising initiative. An herbal medicated chewing gum can be formulated with ingredients that have been scientifically validated for managing mouth ulcers. Traditional medicine provides valuable protocols for treating various disorders, and the use of plant-derived chemical substances has been integral to human health since ancient times. Notably, approximately 50% of new chemical entities introduced over the past two decades have origins in natural products. Recent advancements in technology have reignited interest in natural products for drug discovery. It is essential to focus on isolating and characterizing the active principles of these herbs and understanding the relationship between their structure and biological activity. This research could pave the way for innovative treatments that leverage the benefits of natural remedies.

Medicated chewing gum indeed stands out as an exceptional drug delivery system when compared to chewable tablets, lozenges, and other similar formulations. Its unique characteristics allow it to serve as a carrier for a wide range of drugs, providing both local and systemic effects within the oral cavity. The ability of medicated chewing gum to meet the high-quality standards of the pharmaceutical industry is significant. It can be formulated to achieve various release profiles for active substances, making it versatile for different therapeutic applications. Looking ahead, it's likely that medicated chewing gum will gain popularity as a preferred method for delivering drugs locally to the oral cavity. Its advantages, such as ease of administration anytime and anywhere, along with its pleasant taste, enhance product acceptability. These factors contribute to its potential to become a first-choice option in the future, especially for patients seeking convenient and effective medication delivery.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed

References

- [1] pooja Mishra*, Jitendra Banweer, Praveen Tahilani, Prem Samundre and Sarika Shrivastava,Herbal chewing Gum to Treat Mouth Ulcer using Guava Leaf and Turmeric Rhizomes,2023.DOI: 10.46998/IJCMCR.2022.21.000524.
- [2] Anjali Teresa*,K.Krishnakumar.,Dinesh kumar B & Anish JohnHERBAL REMEDIES FOR MOUTH ULCER: A REVIEW,2017.ISSN 2277-8330
- [3] Govind Goinward,Herbs used in treatment of mouth ulcer:an overview 2023.
- [4] Suraj D. Thakare, Sujata R. Rajewar, Mithu B. Gite, Pavan V. Birgad, Ujwala T. Salve. REVIEW ON HERBS USE IN TREATMENT OF MOUTH ULCER.
- [5] Shubham Mittal,Ujjwal Nautiyal,A Review: Herbal Remedies Used For The Treatment of Mouth Ulcer2019.
- [6] Thevarkar Shreya Dattatray, Sonali S Sonawane,Review on: Herbs Used in Treatment of Mouth Ulcer.2024.
- [7] Yogeshwari D. Lohar¹, Manoj Mahajan, Aman B. Upaganlawar.Review Article-Beneficial applications of herbal medicine in the problems associated with women health
- [8] Paul Posadzki,Leala K Watson,Edzard Ernst,Adverse effects of herbal medicines: an overview of systematic reviewsPMCID: PMC5873713
- [9] Jerry Kennard, what to do about Ulcers in the Mouth, 2018.
- [10] Raj Singh TR, Shaikh R, Garland MJ, Woolfson AD, Donnelly.RF. Mucoadhesive drug delivery systems.J Pharm Bioallied Sci,2011; 3(1): 89–100.
- [11] Chien YW. Novel Drug Delivery Systems, Marcel Dekker, New York, II edition, Revised and expanded, 1992; 139140.
- [12] Edgar W, Geddes D. Chewing gum and dental health -a Review, Br Dent J. 1990; 168: 173-177.
- [13] Sanap Deepali Sanjay, Godge Ganesh R.* Recent Trends in Medicated Chewing Gum Technology:A Review on History, Formulation Strategies and Characterization.
- [14] J.Gomathi*, Sathishkumar .P, Sheik Muhammad Tharves .S.Salem, A Review on Medicated Chewing Gum as a Novel Drug Delivery System.2022.
- [15] Jacobsen J, Christrup LL, Jensen NH. Medicated Chewing Gum: Pros and Cons, American Journal of Drug Delivery, 2004; 2(2): 75-88.
- [16] Sanap Deepali Sanjay, Godge Ganesh R.* Recent Trends in Medicated Chewing Gum Technology:A Review on History, Formulation Strategies and Characterization.
- [17] Deeksha Sharma¹, Priyanka Namdeo², Priti Singh³Phytochemistry & Pharmacological Studies of *Glycyrrhiza glabra*: A Medicinal Plant Review, 2021.ISSN 2277-8330
- [18] hadma Wahab 1, *Sivakumar Annadurai,Shahabe Gotam Das,Wasim Ahmad,*Md Faruque Ahmad,Geetha Kandasamy,Rajalakshimi Vasudevan, Md Sajid Ali,Mond Amir,*Glycyrrhiza glabra* (Licorice): A Comprehensive Review on Its Phytochemistry, Biological Activities, Clinical Evidence and Toxicology.PMCID: PMC8703329
- [19] Hayashi H, Sudo H, Economic importance of licorice, PlantBiotechnology, 2009, 26(1): 101–104
- [20] Prabhu Dayal Rajan, Pradeep Kumar Sharma, Shekhar Prakash Kushwaha, Guru Dayal Yadav, Ashish Verma,Manish Shishodia, A REVIEW ON Capsicum Annuum (A HERBAL BOON)..
- [21] J. Manju, Mutum Sangeeta Devi, Ravi Ranjan 3 and Francyteena, ORAL ULCERS –A REVIEW,2021.