



A Review on: Formulation and Evaluation of Herbal Medicated Chewing Gum

Suvarna T*

Department of Pharmacy, Dr. Babasaheb Ambedkar Technological University, India

*Corresponding author: Suvarna Thube, Department of Pharmacy, Dr. Babasaheb Ambedkar Technological University, Matoshri Institute of Pharmacy, Nashik, Maharashtra, India, Tel: 7559415147; Email: thubesuvarna780@gmail.com

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Abstract

One portable method of medicine delivery is chewing gum. It may be used to provide medications orally, either systemically or locally. In recent years, significant progress has been made in research and technology related to the oral medication administration route. Medicated chewing gum has gained international attention throughout the year due to its ability to promote patient compliance in both pediatric and geriatric patients as well as the general population. The Mayan Indians used to clean their teeth and refresh their breath by chewing tree resin from the sapodilla tree a thousand years ago. Over the course of the year, herbal chewing gum has been more widely accepted as a medication delivery method. Herbal chewing gum today contains a number of substances. A variety of characteristics, including color, stickiness, hardness, and in vitro drug release, are assessed for the prepared product. Chewing gum can be utilized as a portable medication delivery mechanism for oral drug administration, both systemic and local. The majority of people find chewing gum to be enjoyable. Medicated gum preparations frequently require organic solvents to solubilize the active ingredients, and it can be challenging to remove these organic solvents from the finished product.

Keywords: Chewing Gum; Drug Delivery System; Medicated Chewing Gum; Oral Health; Gum Base; Agent

Abbreviations: IBS: Irritable Bowel Syndrome; API: Active Pharmaceutical Ingredient.

Introduction

Definition of Chewing Gum

“Medicated chewing gum contains one or more active ingredients that are released by chewing; it is a solid, single-dose preparation that must be chewed and not swallowed” [1]. Since humans discovered the enjoyment of chewing a variety of substances in ancient times; chewing gum has been utilized worldwide. The Mayan Indians used to clean

their teeth and refresh their breath by chewing tree resin from the sapodilla tree a thousand years ago. The World War II shortage of natural gum bases aided in the creation of the synthetic gum bases that are still in use today [2].

Herbal chewing gum is a unique medication delivery product that is designed to be either systemically absorbed through the oral mucosa or used locally to treat oral ailments. It contains a gum base with pharmacological active component. Herbal chewing gum is thought to be a medicine delivery mechanism or a vehicle for delivering active ingredients that enhance nutrition and overall health [3]. The majority of people find chewing gum to be enjoyable.



Chewing gums are portable medication administration devices. The gum core of a chewing gum typically has one coating or none at all. Chewing gum has relatively little water content and doesn't need any preservatives. Chewing gum is typically made up of a gum base—a water-insoluble phase—as well as other components. Gum that is meant to be chewed but not swallowed is a cohesive, soft substance. Gum base, sweeteners, softeners/plasticizers, flavors, colors, and, usually, a hard or powdery polyol coating make up modern chewing gum [4].

These include different softeners, food coloring, preservatives, flavorings, and powdered sugar, the amount and grain size of which determine how brittle the resulting gum will be; corn syrup and/or glucose, which act as humectants and coat the sugar particles to stabilize their suspension and keep the gum flexible; etc [5]. In his 1999 analysis of chewing gum and dental health. To get the active ingredient into the systemic circulation and produce a systemic impact, there are two alternative absorption mechanisms. When a drug is immediately absorbed through the buccal membrane, it skips the G.I. tract's metabolism and the liver's first-pass action; as a result, chewing gum may require a lower dosage than other oral delivery methods [6].



Figure 1: Chewing Gum.

Advantages of Chewing Gum

1. High bioavailability and quick onset of effect.
2. High level of kid acceptance [7].
3. The bioavailability of medications is enhanced by circumventing hepatic first-pass metabolism [8].
4. Chewing gum is a common treatment for oral conditions such as fungal infections, mouth ulcers, bad breath, and dental plaques [9].
5. Simple administration in the absence of water encourages better patient compliance.

6. Less adverse effects.
7. Systemic impact.
8. Local impact.
9. Chewing gum causes the mouth to bite frequently, which improves facial blood flow and trains the muscles used for biting and chewing.
10. Chewing gum may lessen foul breath and protect your teeth [10].

Disadvantages of Chewing Gum

1. Children who chew gum for extended periods of time may get earache and ocular muscle pain [11].
2. Chewing gum makes you swallow more air than you should, which can aggravate bloating and pain in the abdomen which are symptoms of irritable bowel syndrome (IBS).
3. Gum chewing can harm the materials used in dental fillings.
4. Chewing gum, particularly mint-flavored gum, lowers a person's consumption of nutrient-dense foods like fruits and vegetables.
5. Allergies and headaches can also result from chewing gum abuse.
6. Indigestion and heartburn may also result from this.
7. When chewing gum, the sugar stays in the oral cavity for a long period. Bacteria in the oral cavity then convert the sugar to acid, which erodes the enamel of your teeth and damages them.
8. Chewing gum's artificial sweeteners, like sorbitol and mannitol, irritate the intestines [7].

Health Benefits of Chewing Gum

1. Gum helps with memory.
2. Gum chewing lessens stress-related symptoms.
3. Gum assists with weight management.
4. Gum helps with digestion.
5. Gum chewing promotes dental health.
6. Chewing gum helps avoid bad breath and maintain better oral hygiene.
7. Gum helps people stop smoking.
8. Address halitosis [7].

Types of Chewing Gum

Mint, peppermint, spearmint, wintergreen, cinnamon, licorice, sour apple, cherry, grape, orange, watermelon, strawberry, lemon, and blueberry are among the most often consumed tastes. Chewing gum is available in a range of sizes, forms, and flavors. Gum comes in a variety of forms, but it is typically in the form of a little stick or wad. In essence, chewing gum is created by mixing a water-soluble phase of flavors, sweeteners, and food coloring with a water-insoluble

phase. Chewing gum comes in a variety of forms that are intended for oral hygiene. Gums are used to clean teeth, whiten teeth, and provide a fresh breath [12].

1. Medicated gum
2. Bubble gum
3. Tube gum
4. Ball gum
5. Tab gum
6. Nicotine gum
7. Wrap gum
8. Sugar free gum

Composition of Medicated Chewing Gum

Chewing gum with medicinal properties is a concoction of natural or synthetic gum, resins, tastes, coloring agents, and sweeteners. Chewing gum is composed of two elements.

1. Water insoluble gum base part
2. Water soluble bulk portion [13].

Water insoluble gum base parts are: a) Elastomers: The preparation uses a polymer with a high elongation characteristic to control the gluey texture and provide the chewing gum flexibility [14].

b) Fillers or texturizers: (2–60% by weight of gum base): They facilitate mixing and other operations and give the overall appearance more texture [15].

c) Plasticizers: (3–20% by weight of gum base): This ingredient adds softness and convenience to chewing gum formulations. By softening elastomers, decreasing brittleness, and increasing flexibility, it enhances gum quality [16,17].

Water soluble bulk portion are: a) Flavoring agents: For instance, artificial oils and essential oils such as citrus, clove, anise, peppermint, and spearmint oils [18].

b) Softeners and Emulsifiers: Two immiscible phases are mixed with the use of emulsifiers, and the softness and bubble-forming capacity are enhanced by softeners [19]. Softeners that are frequently utilized include glycerin, lecithin, and fatty acids such as stearic acid, palmitic acid, oleic acid, and linoleic acid [20].

c) Coloring agents: In addition, the chewing gum's formulation contains natural culinary pigments and hues [21].

d) Sweetening agents (50-65% of gum base): Prescription formulations employ these substances to enhance flavor [22].

Materials and Methods of Preparation of Chewing Gum

Materials

Gum base: Waxes, softeners, and food-grade polymers combine to form a gum base. The edible and soluble chewing

gum (sugar and flavoring ingredient) is supported by gum base, an inert and insoluble nonnutritive substance. As in gum ghatti and resin gum.

Honey: Honey has several applications, including being a nutritive, soothing, mild laxative, sweetener, antibacterial, and bactericidal. It is also a key ingredient in cough mixes and linctus's. In addition, it serves as a delivery system for pills in Ayurvedic and Unani medicines. Lately, it has also been utilized in the manufacturing of lotions, creams, soft beverages, and candies. It serves as a sweetening agent as well [23].

Sweeteners: Large Polyol While intense sweeteners are designed to extend the sweetness effect, sweeteners are responsible for the initial sweetness. The most significant of them are that the added sugar in chewing gum serves as a bulking agent, flavoring and coloring agent, texture modifier, preservative, and sweetener.

Active Pharmaceutical Ingredient

The bacteria that cause the majority of tooth decay, streptococcus mutants, are more susceptible to the antibacterial effects of cinnamon oil. However, oral tissue becomes irritated by cinnamon oil.

It serves as a mouth freshener, analgesic, antifungal, antidepressant, carminative, antibacterial, astringent, antiseptic, immuno-stimulant, detoxifying agent, improves brain function, toothache, decreases ulcer, soothes sore throat, and relieves headaches. Such as cinnamon oil

Flavoring Agent: A variety of flavoring agents are used to improve flavor in chewing gum. Carminative, Flavoring agent, Aromatic and Stimulant e.g., *cardamom* [24].

Coloring Agent: It has been shown that reddish chewing gum can be effectively colored with *P. cruentum* algal biomass. Stable coloration acquisition is a significant advance for these kinds of goods [25].

Method of Preparation of Chewing Gum

Every component was precisely weighed in accordance with formulation (Table 1). In the mortar and pestle, crush the gum base. Pour in a sufficient amount of distilled water, combine the honey thoroughly, and carefully swirl the ceramic dish. The dish was held at a temperature of between 35 and 45 degrees Celsius in a water bath. Next, the medication cinnamon oil was added to the bulk that was above. The aforementioned mixture was stirred continuously for 30 minutes while the appropriate amounts of sugar, coloring agent, and flavoring agent were added. After pouring the bulk into the mold, it was left to cool at ambient temperature. The gum fragments were taken out [26].

Formulation of Herbal Chewing Gum

Sr. No.	Ingredients	Quantity	Role
1	Gum resin	1gm	Flexibility
2	Honey	1gm	Antioxidants
3	Cinnamon Oil	0.1gm	Antibacterial agent
4	Sugar	Q.S.	Sweeteners
5	Elaichi	Q.S.	Fresheners
6	Salt	0.1gm	Flavor

Table1: Formula for Chewing Gum.



Figure 2: Formulated Chewing Gum.

Evaluation Parameters of Chewing Gum

Evaluation of Gum Base: Physical appearance, we visually inspect the product in multiple batches to check for organoleptic qualities like color, taste, smell, and appearance. In order to conduct the texture research, the gum is physically pushed between the thumb and finger, and its quality is assessed [27].

Color: The color of the gum base is pale yellow color.

Stickiness: The chewing gum made of herbs was put on a level surface. After pounding a 250-gram mass on it for ten minutes, the bulk began to attach to the hammered surface [28].

Hardness: Using a Monsanto hardness tester, the average hardness and standard deviation of chewing gum's hardness were recorded.

Elasticity Study: One of the most significant characteristics of chewing gum is its suppleness. Both improved patient compliance and the appropriate release of the active component from the product depend on elasticity [29].

In-Vitro Drug Release Study: The medicinal chewing gum's

active ingredients are released via a mechanical chewing mechanism, a self-made contraption that simulates human chewing. The mechanism consists of a chamber to hold the releasing medium and a piston that strikes the gum in an erratic manner. The chamber is kept at a constant temperature by moving warm water around it. A 60 beats per minute piston strike rate is applied to the gum [30].

Chewing gum testing equipment, which was a self-made device that was a modification of a disintegration unit, is used for in vitro drug testing. This stiff basket rack system, which was previously holding six cylindrical glass tubes, has been replaced with a detachable stainless steel still road with a Teflon bead that moves vertically up and down in a glass cylinder with a capacity of 900ml at a rate of 50 cycles per minute. The adjusting screw, which is placed on top of the stainless still road and serves to secure the road to the disintegration equipment, allows you to change the length of the road [31].

Stability Study: Since chewing gum is less reactive than other oral components and has low moisture content, it is considered to be a very stable product. The shelf life, storage circumstances, and the ingredients included in the chewing gum all affect how stable the product is [32]. The chewing gum formulation contains antioxidants to stop the active therapeutic ingredients from oxidizing. Preservatives do not need to be added because the formulation has low water content and will not develop microbiologically. With the use of appropriate materials, certain of the formulation's components can be coated or encapsulated to reduce unintended contact between the parts and to a greater extent within the compounds [33].

Weight Variation Test: Every batch of chewing gum was independently weighed using an analytical balance. After computation, the average weight and standard deviation were determined to be in an acceptable range.

Problem associated with the manufacturing of chewing gum in chewing gum formulations, the most frequent processing problems are sticking, laminating, picking, and capping. Chewing gum products tend to taste or smell unpleasant due to the bad taste of most pharmaceutically active compounds. Some of the active ingredients cause irritation to the mucosal barrier, while others break down fast and are therefore not appropriate to employ in the formulation. In the above-mentioned processes, the gum base is heated to facilitate easier ingredient mixing. At high temperatures, the thermo-labile chemicals, flavors, and active ingredients break down. Medicated gum preparations frequently require organic solvents to solubilize the active ingredients, and it can be challenging to remove these organic solvents from the finished product. Even in minute quantities, these chemical solvents can be harmful to your health [33].

Pharmaceutical Significance of Chewing Gum

1. Sugar-free chewing gums are beneficial to your teeth. The study found that using sugar-free chewing gum after meals helps to remove plaque. Dental caries development is significantly influenced by the pH of the mouth. In order to prevent dental cavities, sugar-free chewing gum has been suggested as an addition to brushing after meals.
2. As an oral drug delivery method, medicated chewing gum is very helpful in treating and preventing nausea and motion sickness [32].
3. It has been demonstrated that chewing gum helps alleviate dental habits and sudden cravings. There is hence a justification for the active moiety to be present in chewing gums that tend to help with weight management.
4. It has been shown that chewing gum formulations absorb more quickly than pill formulations, which leads to quicker pain alleviation.
5. Only a small portion of the released nicotine is absorbed by the buccal mucosa; instead, it is eaten and goes through first-pass metabolism, according to a pharmacokinetic study of nicotine gum. The study found that the buccal route only absorbs about 80% of the nicotine generated [33].

Result

The drug concentration of all the formulations made using the standard method was found to be in the range of %, which is satisfactory. The formulations are all light yellow in color, soft in nature, and exhibit good consistency, but they are also sticky. The amount of cinnamon oil in every mixture is also crucial.

Conclusion

For ailments including motion sickness, nausea, allergies, discomfort, headaches, and infections that need for a rapid initiation of action, chewing gum has the potential to become the preferred means of delivering medication. We can conclude that chewing gum will become more widely accepted by patients in the future, including geriatric, pediatric, and general populations, in light of the benefits of medicated chewing gum as a novel drug delivery system, such as protection against acids and enzymes, increased alertness and cognitive functions, low first pass metabolism, taste masking of many drugs, smoking cessation, dental caries, mouth ulcers, and so on.

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