

A Dissertation Entitled

**“GET A BOOST OF ENERGY ANYTIME ANYWHERE WITH  
MEDICATED CHEWING GUM”**

Submitted to **Savitribai Phule Pune University**



As a part of Curriculum of Bachelor of Pharmacy Course

(Academic Year: 2022 - 23)

**Submitted By:**

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Sinhgad Technical Education Society's

Sinhgad College of Pharmacy,  
Vadgaon (Bk.), Pune- 411 041

2022 - 2023



**“GET A BOOST OF ENERGY ANYTIME ANYWHERE WITH  
MEDICATED CHEWING GUM”**

**BHAGYESH . K . RAJPUT**

(Final Year B. Pharm)

A

**PROJECT**

Submitted to

Savitribai Phule Pune University, in partial fulfillment of the  
Requirements for the degree of

**BACHELOR OF PHARMACY**

**AISHWARYA JAIN**

Under the guidance of

(M. Pharm, Phd Research Scholar)

SINHGAD COLLEGE OF PHARMACY  
S.NO.44/1, OFF SINHGAD ROAD  
VADGAON (BK) PUNE.



### Declaration by the candidate

I the undersigned wish to state that the work embodied in the dissertation entitled, "**GET A BOOST OF ENERGY ANYTIME ANYWHERE WITH MEDICATED CHEWING GUM**" forms my own contribution to the research carried out under the guidance of **MS . AISHWARYA JAIN** at the Sinhgad College of Pharmacy, S.No. 44/1, Vadgaon (BK), Pune-41. This work has not been submitted for any other degree of this or any other University. Whenever references have been made to previous works carried out by others, it has been clearly indicated as such and included in the Bibliography.

**BHAGYESH. K .RAJPUT**

**Final Year B. Pharm,  
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**Date:**



# CERTIFICATE

This is to certify that the work presented in the dissertation entitled  
**“GET A BOOST OF ENERGY ANYTIME ANYWHERE WITH MEDICATED CHEWING GUM”** has been carried out by  
**BHAGYESH. K .RAJPUT**, of STES's Sinhgad College of Pharmacy, Pune, under the guidance of **AISHWARYA JAIN** Professor, Dept. of Pharmaceutics, STES's Sinhgad College of Pharmacy, Pune.

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Place: Pune

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## ACKNOWLEDGEMENT

This project is not the result of an individual effort but is the product of collective wisdom and experience of all those who have stood by me in all my efforts for successfully completing my project.

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My journey has just begun and I hope it continues to be a source of inspiration to achieve every success in my life.

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## PROJECT SUBMISSION

Project Work submitted by Final Year B. Pharm Student to Savitribai Phule Pune University, as a part of curriculum

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### **Abbreviations**

<u>SCG</u>	<u>Synthetic chewing gum</u>
<u>NCG</u>	<u>Natural chewing gum</u>
<u>MCG</u>	<u>Medicated chewing gum</u>

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# INTRODUCTION

## **1. INTRODUCTION**

### **1.1 ENERGY BOOSTING CHEWING GUM :**

Energy boosting chewing gum is a type of chewing gum that contains caffeine as one of its main ingredients. Caffeine is a stimulant that can increase alertness and energy levels, and it is commonly found in beverages such as coffee and tea.

Energy boosting chewing gum is designed to deliver a quick and convenient energy boost to users who may not have time to drink a cup of coffee or energy drink. The gum is typically marketed as a way to enhance mental performance, improve concentration, and combat fatigue.

The amount of caffeine in energy boosting chewing gum varies depending on the brand, but it is generally lower than the amount found in a cup of coffee. This is because the caffeine is absorbed more slowly through the lining of the mouth than through the digestive system, so the effects of the caffeine may be less intense but also longer-lasting.

However, it is important to note that excessive consumption of caffeine can have negative side effects, such as jitteriness, anxiety, and trouble sleeping. Therefore, it is recommended that users of energy boosting chewing gum monitor their caffeine intake and use the gum in moderation. Chewing gum has been proven as a Modified Drug Delivery System, as it is being replaced over the conventional oral dosage forms<sup>[1]</sup>. Energy Boosting Chewing Gum can also be helpful for people regularly going to gym maximum people take black coffee before going to gym so to save time the chewing gum containing caffeine can be used. It will also be helpful for students staying away from home in hostels or PG s they can take this chewing gums so that they need not need any type of heaters and also save a lot of time. It is somehow different from medicated chewing gum as “Medicated chewing gum (MCG) is defined by the European Pharmacopeial guidelines for pharmaceutical dosage forms issued in 1991 by the Committee for Medicinal Products for Human Use (CPMP) as - solid single dose preparations with a base consisting mainly of

gum that are intended to be chewed but not to be swallowed, providing a slow steady release of the medicine contained".<sup>[2,3]</sup> Using medicated chewing gum has many advantages with respect to conventional dosage forms. To name a few, MCG has a local and systemic action, ease of administration, lesser first pass metabolism, higher bioavailability of drug, higher patient compliance, no Gastrointestinal irritation, reduced risk of overdosing, no requisition of water, excellent for acute medication, gives pleasant taste, controls bad breath and much more.<sup>[4,5,6,7,8.]</sup>

## **1.2.HISTORY OF MCG**

Many years ago, people started using chewing gums after experiencing the pleasure of chewing a variety of substances. Over a thousand years ago the Mayan Indians chewed tree resin (chicle) from the sapodilla tree in order to clean their teeth and freshen their breath. Shortage of natural gum bases during World War enhanced the development of the synthetic gum bases that are used today. Spruce gum, which was manufactured in 1848, was the first chewing gum product to be manufactured commercially called "STATE OF MAINEPURE SPRUCE GUM." Later in 1928, chewing gum containing drug acetylsalicylic acid "ASPERGUM" was introduced commercially in market as a medication for pain relief.<sup>[1]</sup>

## **1.3.ADVANTAGES OF ENERGY BOOSTING CHEWING GUM (MCG).<sup>[4,5,..]</sup>**

Caffeine chewing gum can offer several potential benefits, including:

1. Quick absorption: Chewing gum allows for quick absorption of caffeine through the mucous membranes in the mouth, which can result in faster onset of effects compared to drinking coffee or tea.
  
2. Convenience: Caffeine chewing gum is portable and easy to use, making it a convenient option for people who need a quick energy boost on-the-go.

3. Improved cognitive function: Caffeine is a stimulant that can help improve cognitive function, including attention, alertness, and memory.
4. Enhanced athletic performance: Caffeine has been shown to improve endurance and reduce perceived exertion during exercise, making it a popular choice among athletes.
5. Reduced calorie intake: Caffeine chewing gum may be a lower calorie alternative to drinking caffeinated beverages, which can be high in sugar and calories.
6. Fresh breath: Many brands of caffeine chewing gum include ingredients that freshen breath, making it a dual-purpose product. Caffeine chewing gum may have several potential benefits for gym-goers, including:
  1. Improved Focus and Alertness: Caffeine is a natural stimulant that can enhance mental alertness, focus, and concentration. By chewing caffeine gum before a workout, gym guys may be able to stay more focused during their training sessions, which could lead to better performance and results.
  2. Increased Endurance: Caffeine has also been shown to improve endurance and reduce fatigue during exercise. This can be particularly beneficial for gym guys who engage in endurance training or high-intensity interval training (HIIT) workouts.
  3. Enhanced Fat Burning: Caffeine is known to stimulate the metabolism and increase fat burning. By chewing caffeine gum before a workout, gym guys may be able to burn more fat during their training sessions, which could help them achieve their weight loss goals more quickly.
  4. Convenient and Portable: Caffeine gum is a convenient and portable way to get

a caffeine boost before a workout. It doesn't require any preparation or equipment, and it can easily be taken on-the-go.

However, it's important to note that excessive caffeine consumption can have negative side effects, such as increased heart rate, anxiety, and sleep disturbances. It's recommended that gym guys stick to the recommended daily caffeine intake and avoid consuming too much caffeine from other sources. Additionally, it's always a good idea to consult with a healthcare professional before starting any new supplement or dietary regimen.

**Table 1. Available Marketed Formulation of medicated chewing gums.**

Marketed MCG	Active Ingredient	Indication
Nicorette®	Nicotine	Smoking cessation
Aspergum®	Aspirin	Pain relief
Travvel Gum®	Dimenhydrinate	Motion sickness
Hexit®	Chlorhexidine	Dental carries
Endekay®	Vit. C (ascorbic acid)	Vitamin supplement
Stay alert®	Caffeine	Alertness
Chooz®	Calcium carbonate	Calcium supplement

#### **1.4. Types of chewing gums**

Gums used in chewing gum formulation may be of natural or synthetic resource. Synthetic polymers used as a gum base provides more stability to the drug substances and increases the shelf life of drug. Synthetic polymers do not absorb moisture, hence there is no chances of microbial contamination during storage period so addition of preservative can be avoided. Synthetic gum base (SGB) used in chewing gum are chemically inert ,nontoxic, are easily available and are cheaper. On the other hand,

natural gum base has number of advantages namely: ease of availability, biodegradable in nature, biocompatible and avoid the discard of residue.

**Table no 2. Some examples of natural medicated chewing gum**

<b>Natural polymer</b>	<b>Plasticizer</b>	<b>Delivered compounds</b>	<b>Application</b>	<b>References</b>
Corn gluten (zein)	Castor oil	Diphenhydramine hydrochloride	Motion sickness	(Mehta and Trivedi, 2015)
Wheat gluten	Glycerine	Diphenhydramine hydrochloride	Motion sickness	(Shete et al., 2015)
Poly (D, L-lactic acid)	Glycerine	Caffeine	Fatigue	(Mehta et al., 2017)
Corn zein	Oleic acid, glycerine and propylene glycol	cinnamon	–	Megowan et al. (2005)
Root of Kenger plant ( <i>Gundelia tournefortii</i> )	Glucose syrup and glycerin	–	–	(Palabiyik et al., 2018)

### **1.5.Consequences of synthetic polymers**

Synthetic chewing gums made of synthetic polymers are the most commonly used and widely loved products by all age groups. However, after chewing, most individuals throw the waste part of chewing gum anywhere, resulting in environmental trash known as 'gum pollution. Each year, chewing gum generates

more than 105 tons of "plastic" garbage. Thus, the discarded non-biodegradable residue of the gum produces plastic pollution. Every year, enormous sums of money are spent to clean up the abandoned gum from the streets. Again, it has a high potential to trap bacteria inside. Therefore, this widespread habit causes an additional nuisance in this pandemic situation. As a result, the waste part of the gum has multiple dimensions to pollute our environment. Gum disposal has become a major problem across the world. Gum litter can only be reduced by properly disposing of gum:

# REVIEW OF LITERATURE

## **2. Review Of Literature**

### **1. Moradi, A., et.al (2022).**

From this I came to know about Caffeine is a widely-used psychoactive and psychostimulant substance present in various herbal drinks, foods and over-the-counter drugs such as coffee, tea, cocoa, caffeinated chewing gum, energy drinks, cola beverages and some dietary supplements, usually in low to moderate doses without major side effects. While about 60 plant species were found to contain caffeine, the most important cultivated resources of caffeine are Coffea arabica (Rubiaceae), Camellia sinensis (Theaceae), Theobroma cacao (Malvaceae), Cola nitida (Malvaceae) and Paullinia cupana. Many individuals consume caffeine to enhance their impaired performance affected by sleep deprivation. The structure of caffeine is similar to that of neuromodulator adenosine, which is formed by ATP synthesis/breakdown. There are four G-protein-coupled adenosine receptors including A1, A2a, A2b and A318, each of which has its own distinctive pharmacological and tissue distribution profile. The density and sensitivity of adenosine receptors might be different among individuals, however, as the caffeine intake of an individual increases, the adenosine receptors are up-regulated.

### **2. Shaw, J. J. (1993, February 4).**

**Field of the Invention -** This invention is directed to chewing gum compositions comprising wheat gluten and to methods for manufacturing such compositions.

**Description of Related Art -** Conventional chewing gums have achieved broad success in the marketplace. Such chewing gums typically comprise gum base and other components that provide pleasant chewing characteristics. Unfortunately, conventional chewing gums have several drawbacks. Conventional chewing gum bases are not "biodegradable," or digestible, and disposal of conventional chewing gums can cause unsightly litter.

Gluten has been tried as a digestible and biodegradable alternative to conventional chewing gum base. U.S. Pat. No. 3,814,815 to Hashimoto et al., issued on Jun. 4, 1974, for example, is directed to the use of a gum base of gluten denatured more than 10%.

Another attempt to use gluten as a gum base, U.S. Pat. No. 2,469,861 to Cohoe, issued May 10, 1949, is directed to a chewing gum base comprising a combination of zein and wheat gluten. U.S. Pat. No. 2,586,675 to Lutz, issued Feb. 19, 1952, is also directed to an edible chewing gum composition comprising wheat gluten.

Despite the use of gluten in other fields, gluten's use in the chewing gum field has been hampered by a number of organoleptic factors, and no gluten based chewing gum has gained wide acceptance in the American market, regardless of the advantages of a degradable, edible.

### **3. Kanno, S., et.al (2019)**

Chewing gum is a food that by its purpose and design is chewed numerous times. Gum chewing has been reported to increase sympathetic nervous system activity, heart rate, and energy expenditure. A “healthy women study” that compared a group that chewed gum for 15 minutes before oral glucose administration to a group that did not chew gum found that while blood glucose and insulin levels peaked after 30 minutes in both groups, the subsequent decline was significantly faster and larger in the gum group<sup>19</sup>). This suggests that mastication speeds up the insulin secretion response, which causes blood glucose levels to decline faster. Therefore, gum chewing may be an effective means of weight and glucose management. Because exercise increases energy expenditure, gum chewing during exercise would be expected to result in higher energy expenditure than either exercise or gum chewing alone. Hence, combining exercise with gum chewing could be an effective method of weight management. We have previously evaluated the effects of gum chewing while walking on both physical functions such as walking distance, walking speed, step count, and stride length, and physiological functions such as heart rate and energy expenditure in a crossover trial<sup>20</sup>). We reported that the heart rate during walking was significantly higher when the participants chewed gum compared with the control arm when they did not chew gum. Stratified analyses by gender and age ( $\leq 39$  years =young;  $\geq 40$  years =middle-aged and elderly) showed that walking distance, walking speed, step count, and energy expenditure were significantly higher among middle-aged and elderly males when walking while gum chewing compared to walking only.

Thus, gum chewing while walking affects both physical and physiological functions. However, we calculated the increase in energy expenditure based on the increase in walking speed. Therefore, our results for the energy expenditure did not consider the effects of an increased heart rate as a function of the autonomic nervous system.

Therefore, in this study, we aimed to examine the effects of gum chewing on fat oxidation, energy expenditure, and walking indices in participants using a portable metabolic system while walking.

#### **4. McLellan, et.al (2016)**

Caffeine is consumed by over 80% of U.S. adults. This review examines the effects caffeine has on cognitive and physical function, since most real-world activities require complex decision making, motor processing and movement. Caffeine exerts its effects by blocking adenosine receptors. Following low ( $\sim 40$  mg or  $\sim 0.5$  mg kg $^{-1}$ ) to moderate ( $\sim 300$  mg or 4 mg kg $^{-1}$ ) caffeine doses, alertness, vigilance, attention, reaction time and attention improve, but less consistent effects are observed on memory and higher-order executive function, such as judgment and decision making. Effects on physical performance on a vast array of physical performance metrics such as time-to-exhaustion, time-trial, muscle strength and endurance, and high-intensity sprints typical of team sports are evident following doses that exceed about 200 mg ( $\sim 3$  mg kg $^{-1}$ ). Many occupations, including military, first responders, transport workers and factory shift workers, require optimal physical and cognitive function to ensure success, workplace safety and productivity. In these circumstances, that may include restricted sleep, repeated administration of caffeine is an effective strategy to maintain physical and cognitive capabilities.

# **AIM AND OBJECTIVE**

**3. AIM AND OBJECTIVE****Aim:**

The aim of this topic is to explore the concept of energy boosting chewing gum containing caffeine and its potential benefits and drawbacks.

**OBJECTIVES**

1. To examine the effects of caffeine on the body and its potential benefits for energy and alertness.
2. To investigate the role of chewing gum as a delivery mechanism for caffeine and compare it to other forms of caffeine consumption.
3. To explore the potential drawbacks of energy boosting chewing gum containing caffeine, such as possible side effects or addiction.
4. To consider the potential implications of widespread use of energy boosting chewing gum containing caffeine, including its impact on public health and consumer behavior.
5. To suggest recommendations for further research and development of energy boosting chewing gum containing caffeine.

# **PLAN OF WORK**

## **4. PLAN OF WORK**

- Literature Survey
  - Selection and Procurement of Excipients
  - Characterization and Study of Excipients
    - 1. Appearance
    - 2. Chewiness
    - 3. Texture
- Formulation and of Chewing gums
1. Formulation of CG using natural gum base .

# MATERIAL AND METHOD

## 5. MATERIALS AND METHODS

### 5.1.A . WHEAT GLUTEN (Natural gum base)

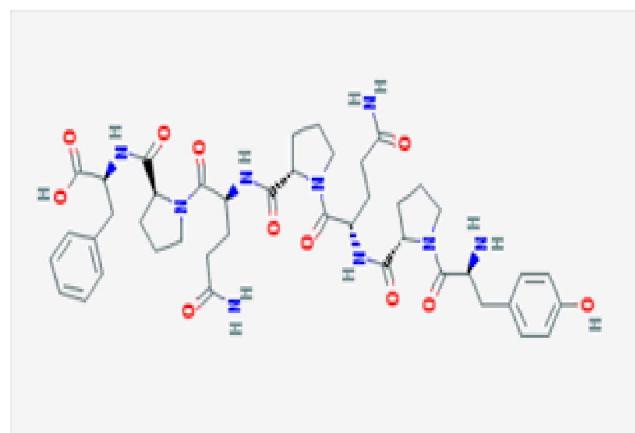
Wheat gluten is a natural protein found in wheat that is commonly used in food processing as a thickening agent and as a source of protein. However, it is not typically used as a gum base for chewing gum.

Gum base is typically made up of a combination of synthetic resins, waxes, and elastomers, which provide the necessary chewiness and elasticity for gum. These materials are chosen for their ability to resist breakdown by saliva and provide a consistent texture.

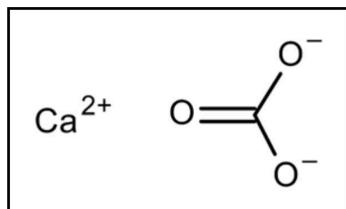
While wheat gluten does have some of these properties, it is not a commonly used gum base material due to its lower resistance to breakdown by saliva and its tendency to become sticky and unpleasant over time.

In addition, many people are allergic or sensitive to gluten, which could limit the market for gum made from wheat gluten.

Overall, while wheat gluten may have some potential as a natural gum base, it is not widely used for this purpose due to its limitations and the availability of other materials that are better suited to this application.



**FIG NO . 1 Wheat gluten**

**5.1.B. Calcium Carbonate<sup>22</sup>****Figure 2. Structure of Calcium Carbonate**

**Synonym** : Chalk, limestone

**Molecular formula**

: CaCO<sub>3</sub>

**Molecular weight**

: 100.09 g/m

**CAS number** : 471-34-1

**Melting point** : 825°C

**Density** : 2.93 g/mL, at 25°C

**Form** : Amorphous

**Colour** : White-beige to slightly beige-grey

**pH** : 9.5-10.5

**Solubility** Insoluble

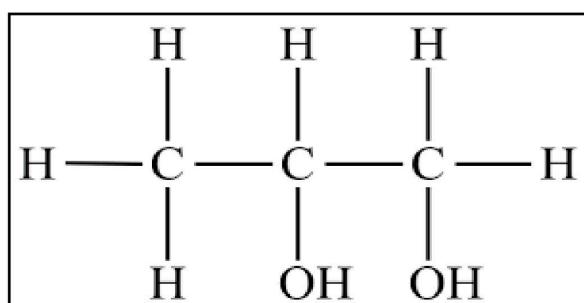
### Description

Calcium carbonate is commonly found as a mineral in the form of mineral calcite and limestone also obtained from various biological sources. It is widely used substance in chemical industry. Medically used as a calcium supplement and antacid. Calcium carbonate has wide application in making building materials such as cement, plasters and glass. Quicklime and hydrated lime are produced from calcium carbonate. It is available in various grades and are used in making various products such as papers, plastics, paints, textiles, sealants, adhesives and in cosmetics.

### Uses

Medically it's been used for making calcium supplement tablets and used in manufacturing antacid. It has wide application in the cosmetic industry. Used in manufacturing of papers, paints, plastics and building materials.

#### 5.1.C. Propylene Glycol<sup>23</sup>



**Figure 3. Structure of Propylene Glycol**

**Synonym** : 1,2-Propylene glycol, 1,2-dihydroxy propane

**Chemical name** : Propane-1,2-diol

**Empirical formula :** CH<sub>3</sub>CHOHCH<sub>2</sub>OH

**Molecular weight :** 76.09 g/mol

**CAS number :** 57-55-6

**Organoleptic properties:** It is a colourless, hygroscopic viscous liquid.

: odourless: 1.0361 g/cu cm at 20°C

: Melting point: -59°C

: Boiling point: 187.2°C

: Viscosity: 0.581 cP at 20°C

### **Solubility**

Propylene glycol (PG) is soluble in water, ethanol, acetone, benzene and chloroform. Also, it is miscible with some essential oils but immiscible with fixed oils.

### **Stability and Storage**

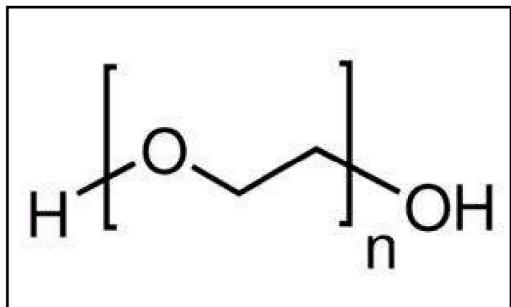
PG is stable at cooling temperature, while exposure to high temperature tends to oxidation resulting in propionaldehyde, lactic acid, pyruvic acid, and acetic acid formation. It is stable with ethanol (95%), water and glycerine. PG must be stored in tightly closed plastic or glass container at low temperature.

### **Functional category**

Pharmaceutical vehicle (solvent), humectant

### **Applications**

PG used as a pharmaceutical vehicle for various purpose. It acts as a humectant also it has been popularly used in cosmetic industry as a carrier or base. PG has been used in various food products such as ice-cream, liquid sweeteners, whipped dairy products, etc. In pharmaceutical industry, PG act as a carrier for the insoluble drugs, also it has been used in alcohol-based sanitizers to prevent the skin from drying.

**5.1.D.PEG 600<sup>24</sup>****Figure 4. Structure of PEG 600****Synonym**

Carbowax, Macrogol

**Chemical name :**

Poly(ethylene oxide)

**Empirical formula :**H-(O-CH<sub>2</sub>-CH<sub>2</sub>)<sub>n</sub>-OH.**Molecular weight :** 570-

680 g/mol

**CAS number :** 25322-68-3**Melting point :** 17-22° C**Density :** 1.12 g/mL at 20°C**Viscosity :** 150-190 mPas at 20°C

**Description:**

PEG 600 is a clear colourless viscous liquid of pH value between 6-7 at 10g/L Odourless and tasteless liquid.

**Solubility**

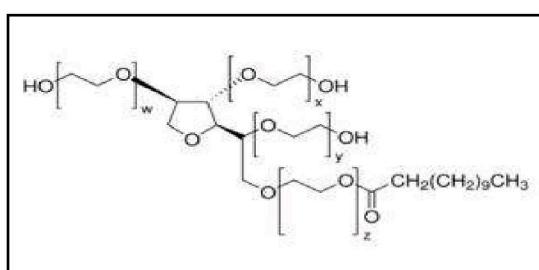
PEG 600 is hygroscopic in nature. It is soluble in water and slightly soluble in chloroform and methanol and insoluble in aliphatic hydrocarbons.

**Stability and Storage**

PEG 600 is stable at normal temperature, as there is increase in temperature it causes loss in molecular weight. Simple alcohols, acids and glycol esters are formed in presence of water, carbon dioxide and aldehydes. It must be stored in tightly closed glass, plastic or aluminium container, away from moisture at normal temperature, to prevent from oxidization takes place above 50°C

**Applications**

PEG 600 have wide range of application in the pharmaceutical and cosmetic industry as ointment bases, in creams, lotions, face lotions, lipsticks and toothpastes. It is used in leather and textile industry as plasticizer and antistatic agent, as lubricants, mould-release agents in the rubber industry and as plasticizers and binding agents in ceramic industry.

**5.1.E. Tween 20<sup>25</sup>**

**Fig.5. Structure of Tween 20**

**Synonym** : Polysorbate 20, Montanox 20

**Chemical name** : Polyoxyethylene (20) sorbitan monolaurate

**Empirical formula:** C<sub>26</sub>H<sub>50</sub>O<sub>10</sub>

**CAS number** : 9005-64-5

**Boiling point** : >100°C

**Density** : 1.1 g/mL

**Description:**

Tween 20 is a lemon to amber-coloured oily liquid at 25 °C with a faint characteristic odour.

**Solubility**

Soluble in water, ethanol, methanol, ethyl acetate and dioxane. Insoluble in mineral oil and petroleum ether.

**Stability and Storage**

Tween 20 undergo autoxidation at room temperature results in changes in the peroxide number, pH, surface tension, and cloud point. Autoxidation is accelerated by light, increased temperature, and copper sulphate. At room temperature, hydrolysis of Tween 20. It should be stored in a well-closed container, protected from light, in a cool, dry place.

**Functional category:**

Non-ionic surfactant, Emulsifier, Dispersing agent.

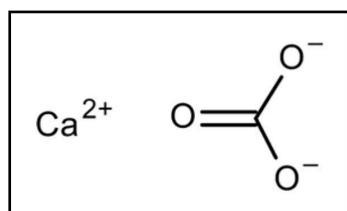
### **Applications**

Tween 20 is used in cosmetics include oil/water emulsifier, detergent, dispersing agent, solubilizer, and stabilizer. It is used as emulsifying agent in various pharmaceuticals.

### **5.2.NATURAL GUM BASE :**

A natural gum base, prolamin, is a storage protein of *Triticum* spp. (wheat flour) (Family - *Germinea* wheat) called as gliadin or gluten.

### **5.2A. Calcium Carbonate<sup>22</sup>**



**Figure 6. Structure of Calcium Carbonate**

**Synonym** : Chalk, limestone

**Molecular weight**

: 100.09 g/mol

**CAS number** : 471-34-1

**Melting point** : 825°C

**Density** : 2.93 g/mL, at 25°C

**Form** : Amorphous

**Colour** : White-beige to slightly beige-grey

**pH** : 9.5-10.5

**Solubility** Insoluble

**Description**

Calcium carbonate is commonly found as a mineral in the form of mineral calcite and limestone also obtained from various biological sources. It is widely used substance in chemical industry. Medically used as a calcium supplement and antacid. Calcium carbonate has wide application in making building materials such as cement, plasters and glass. Quicklime and hydrated lime are produced from calcium carbonate. It is available in various grades and are used in making various products such as papers, plastics, paints, textiles, sealants, adhesives and in cosmetics.

**Uses**

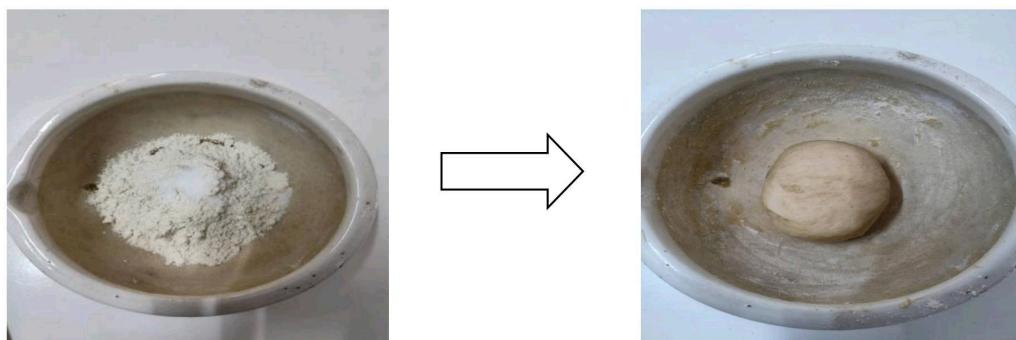
Medically it's been used for making calcium supplement tablets and used in manufacturing antacid. It has wide application in the cosmetic industry. Used in manufacturing of papers, paints, plastics and building materials.

**Formulation and development of medicated chewing gum**

- 1) Gum base + hydrogenated palm oil + plasticizer
- 2) Drug+ Antioxidant + Opacifier + Calcium carbonate were triturated
- 3) And mixed with gum base
- 4) Mixture was triturated until the solid mass was formed
- 5) The gum base was then spread into a thin sheet with a roller and cut into strips .

**Table no – 3 Formulation table**

Category	Ingredients	Batch Code			
		F1	F2	F3	F4
<b>Gum Base</b>	Wheat gluten	2.3	2.3	2.3	2.3
<b>Softener</b>	PEG 600	0.5	0.5	0.5	0.5
	Tween 20	0.7	0.7	0.7	0.7
<b>Plasticizer</b>	Propylene Glycol	1	1	1	1
<b>Filling Agent</b>	Calcium Carbonate	0.3	0.3	0.3	0.3
<b>Sweetener</b>	Saccharine	0.2	0.2	0.2	0.2
<b>Flavors</b>	Peppermint	0.1	0.2	0.3	0.35
<b>Drug</b>	Caffeine	220mg	230mg	240mg	250mg
<b>Total Weight</b>		6.3	6.4	6.5	6.6

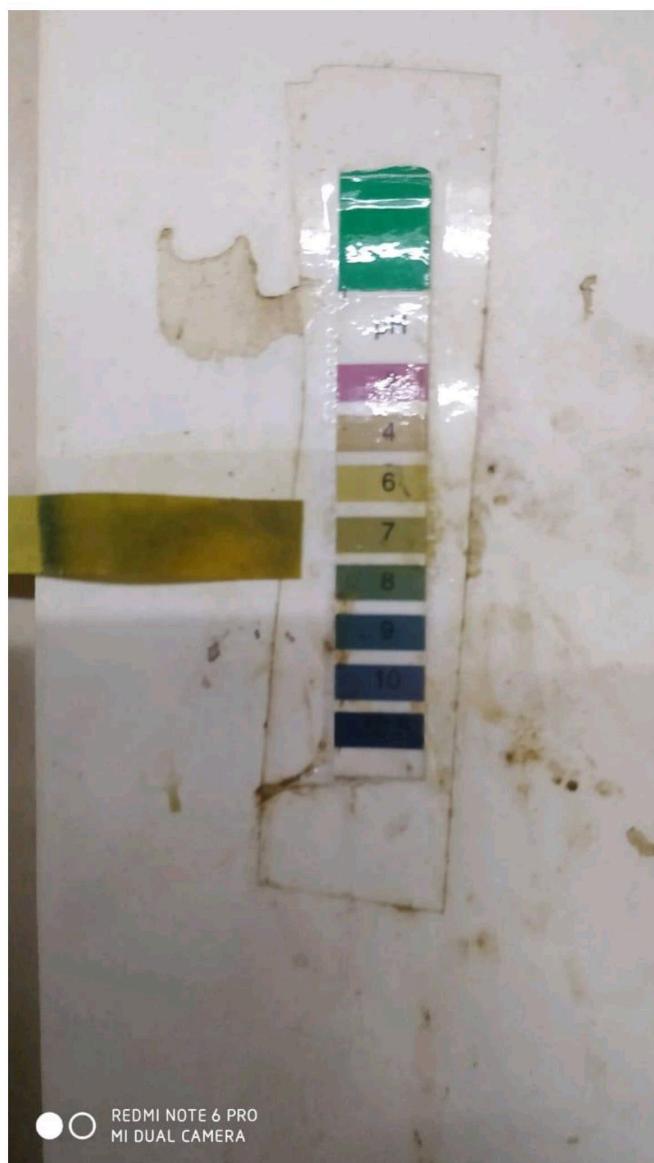
**Figure 7. Diagrammatic representation of formulation of NCG**

## **EVALUATION PARAMETERS**

1. Caffeine content: The amount of caffeine in the chewing gum should be measured to ensure that it is within the therapeutic range. Too little caffeine may not provide the desired effect, while too much can lead to adverse effects.
2. Bioavailability: The bioavailability of caffeine from the chewing gum should be determined to ensure that it is absorbed effectively and provides the desired therapeutic effect.
3. Taste: The taste of the chewing gum is an important consideration as it can affect patient compliance. The taste should be evaluated to ensure it is acceptable and does not interfere with the therapeutic effect.
4. Texture: The texture of the chewing gum is also important as it can affect patient compliance. The texture should be evaluated to ensure that it is easy to chew and does not stick to teeth.
5. Stability: The stability of the chewing gum should be evaluated to ensure that it maintains its therapeutic properties over time.
6. Safety: The safety of the chewing gum should be evaluated to ensure that it does not cause any adverse effects in patients.
7. Efficacy: The efficacy of the chewing gum should be evaluated to determine its effectiveness in providing the desired therapeutic effect.
8. Compliance: The compliance of patients using the chewing gum should be evaluated to ensure that it is easy to use and does not interfere with daily activities

## EVALUATION PARAMETERS –

- 1) Color – It was visually observed .
- 2) Odour – It was smell voluntarily.
- 3) Ph- The ph of formulated chewing gum was evaluated by using the ph paper.
- 4) Weight variation -Weights of four formulations were observed.



**Fig no. 8      Visualization of ph.**

# RESULT

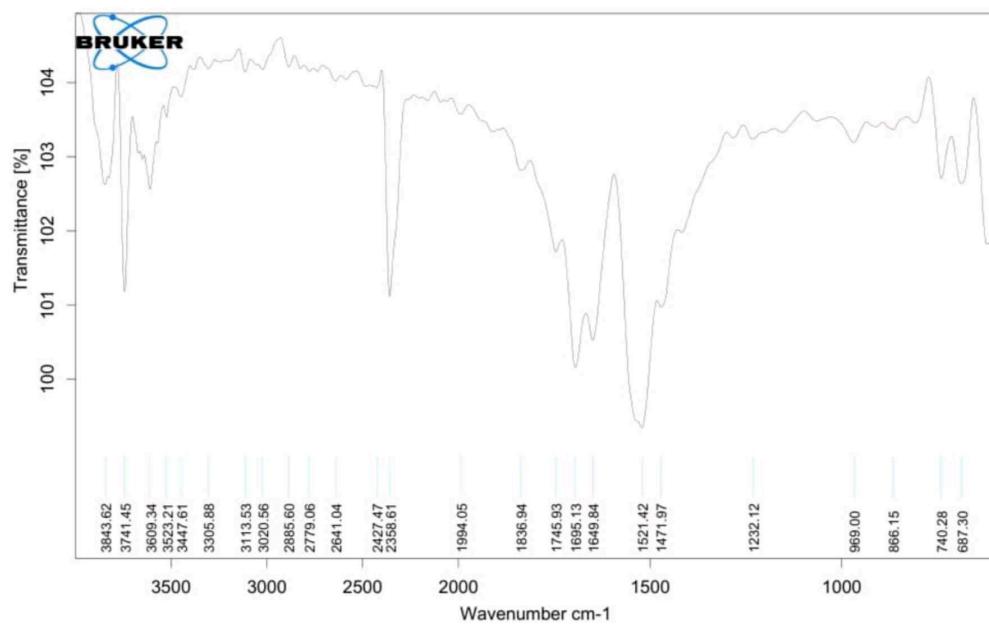
**RESULTS****Table 4. Physical evaluation**

Sr.NO.	PARAMETERS	OBSERVATION
1.	Color	Light Brown
2.	Odour	Sweet
3.	pH	6.8
4.	Thickness	6.671
5.	Hardness	2.66
6.	Weight variation	2.5
7.	Diameter	12.48
8.	Friability	0.196

**Fig.9. Formulation of chewing gum containing caffeine.**

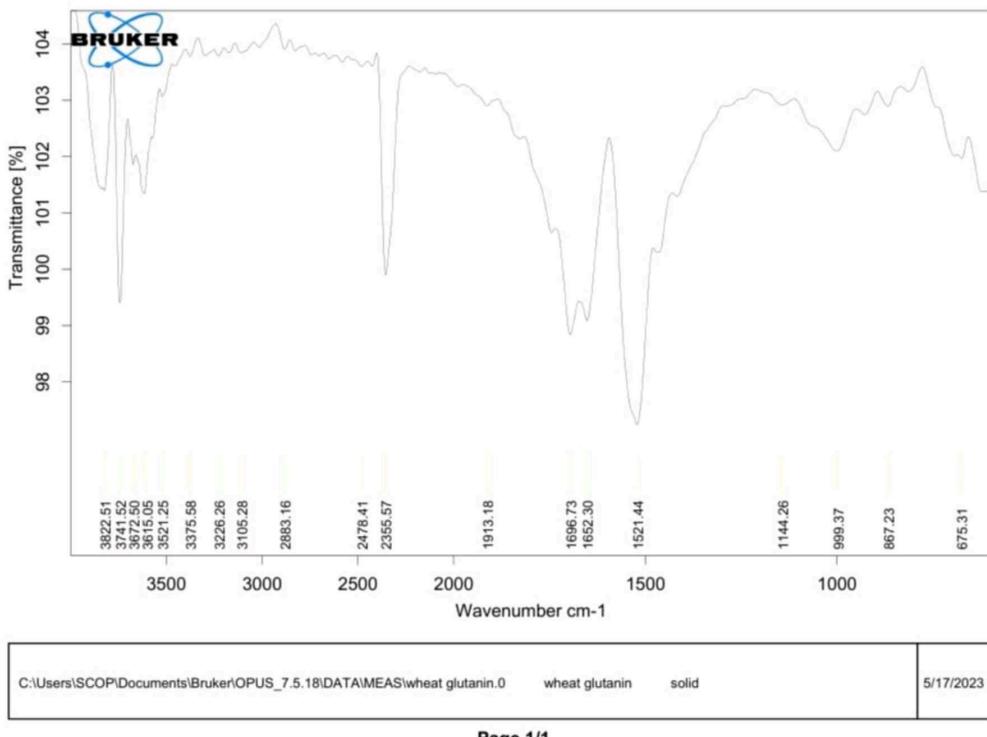
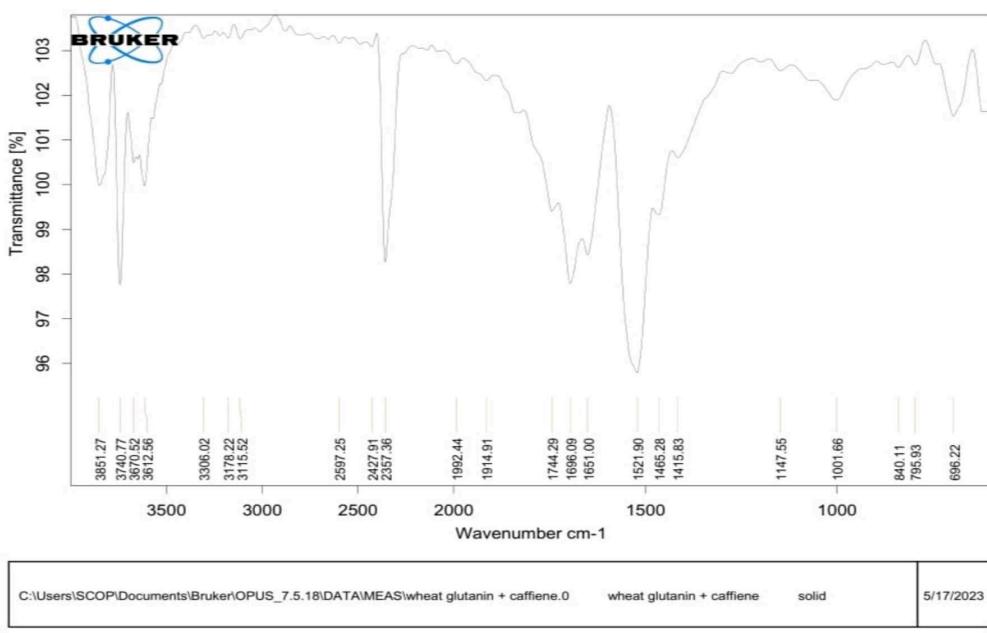
**Table 5. Parameters such as softness, elasticity, stickiness**

<b>Chewing gum type</b>	<b>Softness</b>	<b>Elasticity</b>	<b>Stickiness</b>
<b>Natural chewing gum</b>	<b>1</b>	<b>0</b>	<b>1</b>
<b>Synthetic chewing gum</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Natural chewing gum with caffeine</b>	<b>2</b>	<b>1</b>	<b>0</b>
<b>Synthetic chewing gum with caffeine</b>	<b>1</b>	<b>3</b>	<b>2</b>

**IR of Caffeine**

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**Fig no 10. IR of Caffeine**

**IR of Wheat Gluten****Fig no 11. IR of Wheat gluten****IR of Caffeine + Wheat Gluten [1:99]****Fig no 12. IR of Wheat gluten + caffeine**

**INTERPRETATION OF IR –****Table no 6 – Interpretation of IR spectra**

	<b>Functional Group</b>	<b>Wavelength cm<sup>-1</sup></b>
Caffeine	C=C	<b>1652 cm<sup>-1</sup></b>
	C=O	<b>1753 cm<sup>-1</sup></b>
Wheat Gluten	Amide 1	<b>1650 cm<sup>-1</sup></b>
Caffeine:Wheat gluten[1:99]	C=O	<b>1651 cm<sup>-1</sup></b>

# DISCUSSION

**DISCUSSION**

The formulation of medicated chewing gum by using caffeine as a drug was done by direct method. Caffeine performs various activities such as boosting of energy, increase alertness and concentration. The prepared chewing gum contains caffeine which boosts energy. Four formulations were prepared (F1, F2, F3, F4) out of which F 4 show the best result. Physical evaluation was done and was observed that the color of the chewing gum is light brown , odour was found to be sweet and ph was found to be 6.8.Various parameters like Elasticity Softness Stickiness were observed .Fourier transformed infrared spectroscopy (FT-IR) was performed of caffeine , wheat gluten and mixture of both in 1:99 ratio. So there is no interaction between pure drug ,pure gum base and excipients. It indicates that the drug and excipients are compatible.

# CONCLUSION

**CONCLUSION**

Caffeine performs various activities such as boosting of energy, increase alertness and concentration . Four formulations were prepared (F1, F2, F3, F4) out of which F 4 show the best result. Fourier transformed infrared spectroscopy (FT-IR) was performed of caffeine , wheat gluten and mixture of both in 1:99 ratio. From above it can be concluded that there were no changes in standard wave no of drugs and excipients. So there is no interaction between pure drug , pure gum base and excipients. It indicates that the drug and excipients are compatible. The novel approach of the chewing gum is to boost energy anytime anywhere in short time.

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