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## Research Article

# Nourish With Nature: Beetroot-Enriched Chocolate Creation

Himani Sawant\*, Gaurav Gade, Kartik Bhosale

Department of pharmacy, Shantiniketan College of Pharmacy, Dhotre (Bk.)

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### ABSTRACT

Children love chocolate the most out of all foods, yet they detest medications. Thus, the purpose of this research is to create and develop chocolate. This study's primary goal was to create and assess antioxidant-containing nutritional supplements and chocolate that is nutrient-dense. A variety of products called chocolate are made by combining fat, sugar powder, and cocoa powder to create a solid semifluid. Chocolate is a product that people of all ages, including children, teenagers, and the elderly, like eating. The chocolate formulation includes antioxidant-rich beets along with many other health advantages; oranges are high in vitamin C and antioxidants; dark chocolate is a great source of antioxidants; sugar is used as a sweetener; and tragacanth and almonds are natural solidifiers. According to recent research, eating chocolate with a high flavonoid content can improve blood flow to the brain in both adults and children. Mineral-rich and with a fair quantity of soluble fiber, dark chocolate has it all. Antioxidants, which are abundant in our chocolate and crucial for growth of the human body as a whole, antioxidants in particular help to improve the skin appearance, since it leaves skin looking radiant, healthy, and glossy. Antioxidants lessen the possibility of numerous illnesses, such as heart disease and some types of cancer. Free radicals are scavenged by antioxidants from the body's cells and stop or lessen oxidation-related damage. Antioxidants have the ability to shield against oxidative stress, the damage that free radicals inflict on cells. The as was already said, chocolate is composed of natural ingredients.

### INTRODUCTION

The Covid 19 pandemic is causing agony for all of humanity. Optimizing health requires strengthening the body's immune system, which serves as its natural defense. It's common knowledge that prevention is better than therapy.

Chocolate is the food that people love the most. Children despise medicine, on the other hand. Therefore, the purpose of this study is to develop and design chocolate. The major objective of this study was to develop and evaluate a nutrient-dense

\*Corresponding Author: Himani Sawant

Address: Department of pharmacy, Shantiniketan College of Pharmacy, Dhotre (Bk.)

Email ✉: [himanisawant408@gmail.com](mailto:himanisawant408@gmail.com)

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chocolate and nutritional supplement with anti-inflammatory, insulin-sensitivity-boosting, and performance-enhancing qualities. Creating and assessing nutrition chocolate that is naturally high in fiber, protein, carbs, vitamins, minerals, and other nutrients was the major objective of this study. The physiological and biochemical mechanism via which an organism obtains nourishment for survival is referred to as the nutrition process. It provides nutrients that are needed to create energy and chemical structures. Insufficient nutritional intake leads to malnutrition. Inadequate food consumption, acute or chronic medical conditions, drugs, or aberrant nutrient metabolism can all lead to deficiencies or diseases in certain ingredients. Foods containing chocolate can be combined to create a vast array of flavors and textures. It is the best way to provide medication, particularly to young children. Five primary tastes are detectable by humans: sweet, bitter, sour, salty, and savory. Sweet is one of the most pleasing flavors[1]. Sweet is one of the most pleasing flavors. The goal of the sweet taste is to reveal the extremely calorific saccharides in the injection. In many respects, chocolate is an excellent way to administer active ingredients. The

objective of the current study is to produce herbal chocolate that is rich in antioxidants and offers several health advantages, such as lowering blood pressure, decreasing inflammation, supporting liver and mental health, and increasing energy. Solid confections made from fat, finely powdered coconut sugar, and cocoa (cocoa) are created in a variety of ways. Chocolate is our product's main source of antioxidants. A sophisticated and very adaptable cuisine, chocolate can be combined in a myriad of ways. to evoke a variety of flavor and texture perceptions. Beetroot is also referred to by the common names chard, sea beet, garden beet, white beet, and Chukander (Hindi). The human body benefits from some of its extremely healing characteristics. Beetroot can be boiled, steamed, roasted, or eaten raw. Red beetroot is rich in minerals, such as iron, copper, sodium, manganese, and magnesium. 116% of the recommended daily intake of vitamin C. The main water-soluble antioxidant that keeps the body from producing free radicals and damaging the tissues in the aqueous environment, both inside and outside of cells, is vitamin C. Vitamin C helps shield the ears from colds, sinus infections, and recurring infections[2].

### History of Chocolate[3,4]

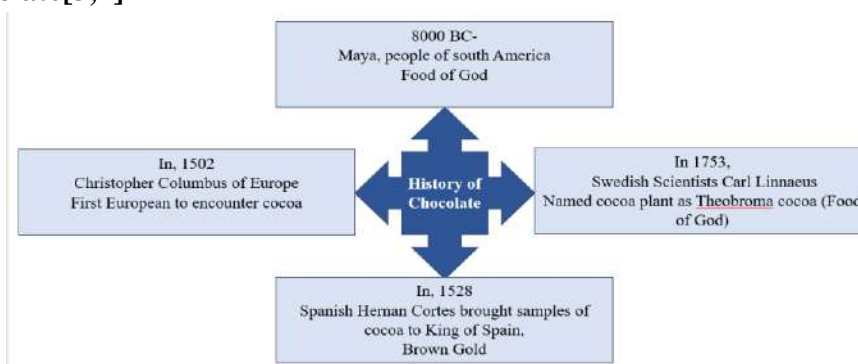


Fig. No. 1 History of chocolate

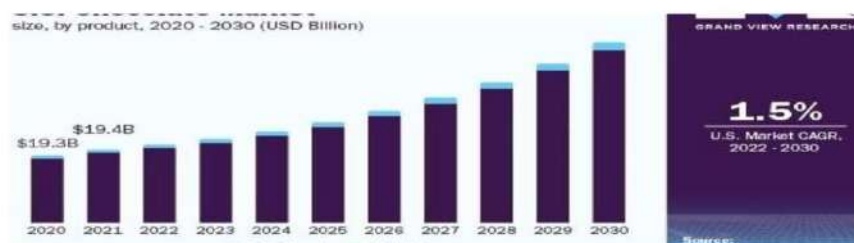
### Present of chocolate

The graph, which is divided into categories for traditional and artificial chocolate goods, shows how the American chocolate market is expected to expand between 2020 and 2030. The market was

valued at over \$19.3 billion in 2020, and it is anticipated to grow over time. It is projected that the market would reach around \$29.4 billion by 2030, with a consistent compound annual growth rate (CAGR) of 1.5% from 2022 to 2030.

Throughout this time, traditional chocolate continues to be the most popular product, whereas artificial chocolate, while still a smaller market, is growing gradually. The ongoing demand for

chocolate goods in the American market is reflected in this trend, with both conventional and artificial categories supporting the growth on the whole.



**Fig. No. 2 Chocolate market gaph**

Possibilities and Difficulties: The price of desired materials, like cocoa, which influences production prices, is the main obstacle in the Indian market. However, one of the current prospects in the Indian chocolate market is the encouragement of innovations and cost-effective manufacturing processes and ingredients. In the chocolate industry, one of the main trends is the shifting demographics of Indian consumers. Additionally, people are choosing alternatives because of their apparent health benefits depending on what is included in them. Put another way, customers are gravitating toward dark chocolate, claiming that its high cocoa content and low sugar content make it healthier. In 2020, India will launch its first "Certified Organic" chocolates. It created at least fourteen distinct product categories[5]. The procurement of cocoa beans from collectives in Kerala affects the earnings of around two thousand farmers. In addition, the producers market the food as healthy by using components like fruits, nuts, and seeds that are well-known for their functions. Furthermore, the market for chocolate keeps growing as more customers become aware of the advantages of consuming cocoa, such as its ability to promote heart health and antioxidant qualities. Consequently, this is increasing the revenue of the chocolate market in India. Due to the Indian custom of giving gifts, chocolates are a common option for a variety of festive occasions and gifts.

The introduction of unique, holiday-themed, gift-wrapped chocolates and chocolate gift sets that are available during the festive season also helps to boost the market[6].

### **Antioxidant property of chocolate**

The cocoa bean is reported to have a wide variety of phytonutrients. Compounds called phytonutrients—the word "phyto" in Greek means "plant"—are present in plants and have emerged as a highly intriguing and promising field of study. Many kinds of polyphenols, which are widely acknowledged as some of the most potent antioxidant and anti-inflammatory substances known to science, are among the most significant phytonutrients found in cocoa. Chocolate contains a number of substances, including flavonoids and polyphenols, that have antioxidant qualities[7].



**Fig. No. 3 Cocoa**

These substances aid in the body's defense against dangerous free radicals, which may otherwise lead to oxidative stress and cell damage. Because it contains more cocoa than milk or white chocolate,

dark chocolate in particular usually has higher quantities of antioxidants. Due to its high antioxidant content, several studies indicate that a moderate amount of dark chocolate consumption may have health benefits, including improved heart health and reduced inflammation. Because the oxidative enzymes polyphenol oxidase (PPO) and peroxidase come into contact with the cocoa beans during fermentation and drying, the polyphenols undergo oxidative destruction. Enzymatic oxidation converts monomeric flavan-3-ols into semi-quinones and quinones. Additionally, these oxidation products polymerize into insoluble tannins with a high molecular weight that are condensed. During roasting, the natural polyphenols may additionally combine with proteins, free amino acids, and mono- or polysaccharides to create novel substances having antioxidant properties[8].

## **NEED AND OBJECTIVES**

### **Need:**

The body needs nutrients in order to function properly and for development, reproduction, and survival. Stronger immunity, better pregnancies and deliveries, and a decreased risk of non-communicable diseases are all associated with improved nutrition for mothers, babies, and children. A balanced diet that includes all the nutrients the body needs is essential to prevent nutrient deficits and hormonal imbalances.

Among the primary reasons of a nutritional deficit are

### **Inadequate intake**

### **Inadequate absorption**

### **An increased requirement of nutrients.**

Multinutrients are crucial for boosting the immune system and preventing a number of illnesses. All living things on our planet require nourishment. Our daily lifestyle changes make it impossible for us to meet our nutrient needs. This provides us with energy and enables our bodies to carry out their fundamental duties. to satisfy the body's

everyday needs. Give the several vitamins, minerals, and nutrients. Thus, utilizing beetroot-enriched chocolate creations is one of the finest ways to nourish with nature and provide your body the nutrition it needs to strengthen your immune system.

### **OBJECTIVES:**

1. To improve the immune function of a person
2. To improve vitamin and mineral levels.
3. To increase overall health and well being.
4. To provide iron supplement during pregnancy.
5. To provide antioxidant supplement like vitamin C and vitamin E.

### **Plan of Work**

For any investigation, an organized and integrated effort with expertise is essential. Therefore, the current research work was planned to be conducted in the laboratories of this college and the various steps that were envisaged are described below:

1. Literature Survey and regular updating of literature was planned by reviewing Textbooks, journals both print and online sources.
2. Selection of drug and excipients.
3. Procurement of drug and polymers and other excipients required for the study.
4. Organoleptic characterization
5. Fruits-Excipients compatibility study of any interaction between fruits and excipients by referring review and research articles.
6. Prepare the product by Referring procedure mention in research articles.
7. Preparation of chocolate syrup by melting 8. Pureed of fruits by grinding
8. Evaluation of developed formulation of BEETROOT-ENRICHED CHOCOLATE
9. By using Organoleptic evaluation, surface pH, Bloom test and Stability test.
10. Project writing and publication.

### **MATERIALS AND METHODS**



**Materials:**

**Beetroot:**

Beetroot (*Beta vulgaris* L.) has a place to the Chenopodiaceae family. It has shining blood red Color. Beetroot is commonly known as beet, chard, spinach beet, ocean beet, cultivate beet, white Beet and Chukander (in Hindi). It has exceptionally therapeutic properties which grant a few positive Impact on the human body[9]. The beetroot has diverse therapeutic properties and help to Secure against heart malady and certain cancers (colon cancer) Beetroot are wealthy in other valuable compound such as glycine, betaine, Saponins betacyanin, carotenoids, folates, betanins, polyphenols and flavonoids. Beetroot contributes to consumer’s wellbeing and prosperity since it has antioxidant property Due to the nearness of nitrogen color betalain. Beetroot are moreover known for its antimicrobial And antiviral impacts and it can too repress the cell expansion of Human tumor cells Beetroot is one of the normal nourishment which boosts[10]. The vitality as it has one of the most noteworthy nitrates and sugar substance plant Beetroot makes a amazing dietary supplement as it is not as it were

wealthy in minerals, vitamins and Supplements but it too has one of a kind



**Fig. No. 4 Beetroot**

Phytochemical compounds (carotenoids, phenolic acids, Ascorbic corrosive) which have numerous therapeutic employments. A few parts of this plant are utilized as antioxidant, upper, antimicrobial, antifungal, Anti-inflammatory, diuretic and carminative. The beetroot is an Soluble nourishment with a pH 7.5-8 and it contains critical sum of vitamin C, vitamin B1,B2, Niacin, B6, B12 and its clears out are great source of vitamin A. Other dialect title of beetroot Bitagacha (Bengali), Bit (Malayalam), Bita (Marathi), Beet (Punjabi), Carkkarai vali kilanku ceti (Tamil), Dumpamokka (Telegu), Salada (Gujarati) and Gajarugadde (Kannada)[11].

**Table no. 1 Taxonomical classification of Beetroot**

Common Name	Beetroot, Sugar beet, Chukander (Hindi)
Scientific Name	<i>Beta vulgaris</i>
Kingdom	Plantae
Phylum	Magnoliophyta
Class	Magnoliopsida
Order	Caryophyllales
Family	Chenopodiaceae
Genus	Beta
Species	Vulgaris

**Orange:**

The Rutaceae family, subfamily Aurantioideae, and subgenus Citrus (Swingle) have three distinct types: Citrus, Fortunella (Kumquat), and Poncirus Trifoliata[12]. There are three genera and eighteen recognized species, however there are also other

naturally occurring hybrids that are widely distributed around the globe due to additional mutations. Nigeria and many other tropical and subtropical regions grow a lot of citrus. Citrus is the second-most productive fruit crop in the world,

producing around 108 million tons, after bananas. Citrus sinensis L. Osbeck, also known as



**Fig. No. 5 Orange**

sweet orange This family includes the orange, which is a key source of vitamins, particularly C, as well as adequate amounts of folacin, calcium, potassium, thiamine, niacin, and magnesium. These compounds can be obtained from a variety of food sources and are almost universally found in plant material[13]. Antioxidant nutraceuticals, also known as phytochemicals, and these functional dietary elements make foods important.

Edible fruits and vegetables contain phytochemicals that, when consumed, may modify human metabolism favorably and ward against degenerative and chronic illnesses. Fruit production has increased. Citrus fruits are the primary source of essential phytochemical elements and have long been prized for their healthful, antioxidant, and nutritious qualities. Oranges' high vitamin and mineral content has been scientifically shown to provide numerous health benefits. Furthermore, it is now recognized that additional physiologically active, non-nutritional compounds present in citrus fruits, such as soluble and insoluble phytochemical antioxidants, It is well recognized that dietary fibers can lower the risk of cancer as well as a number of chronic illnesses, including obesity, arthritis, and coronary heart disease[14].

**Table no. 2 Taxonomic Classification of Orange**

Common Name	Orange, Sweet orange
Scientific Name	Citrus sinensis
Kingdom	Plantae
Division	Magnoliopsida
Class	Dicotyledons
Subclass	Sapindales
Order	Sapindales
Family	Rutaceae
Subfamily	Aurantoideae
Genus	Citrus
Species	sinensis

**Dark Chocolate as an antioxidant:**

Antioxidants abound in dark chocolate. Antioxidants protect cells from oxidative damage caused by free radicals. Since free radicals are linked to aging and may even be the cause of cancer, consuming foods high in antioxidants, such as dark chocolate, can help protect the body from numerous cancer types and delay the aging process. Flavonoids, such as The most prevalent phytonutrients in are proanthocyanidins, anthocyanins, and catechins. cocoa powder, although the chocolate product's composition is subtly different[15]. The raw cocoa beans are

bitter due to the presence of polyphenols, but the The content of chocolate is reduced by up to ten times throughout the manufacturing process. Cocoa beans are processed through several steps in the production of chocolate, including fermentation, drying, roasting, nib grinding and rening, conching, and tempering. It is evident that some avoids are lost in the process of forming Maillard products. Different health impacts result from this process since the antioxidant components in chocolate are significantly reduced compared to the original cocoa beans. In the actual world, people mostly drink low-polyphenol

chocolate. Fermentation is a procedure that results in a significant reduction in soluble polyphenols, procyanidins, and epicatechins as well as the disappearance of anthocyanidins. Flavanols and polyphenols are among the substances found in dark chocolate that have antioxidant qualities. Free radicals are neutralized and oxidative stress is avoided by antioxidants[16]. Over time, oxidative stress can also have a role in the onset of several illnesses, including diabetes, heart disease, Parkinson's disease, Alzheimer's disease, cancer, and eye disorders. The following nutritional information is provided by a 101-gram (g) bar of dark chocolate with 70–85% cocoa solids, per the United States Department of Agriculture Trusted Source. 604 energy units, 43.06 g of fat, 46.36 g of carbohydrates, 11.00 g of dietary fiber, 24.23 g of sugar, 12.02 mg of iron, and 230.00 mg of magnesium are included in the protein content of this meal[17].

#### **Honey:**

The natural product known as honey is made by honeybees (*Apis mellifera*; Family: *Apidae*) from the nectar of flowers. Humans have utilized honey from prehistoric times, around 5500 years ago. The majority of the ancient population, including the Mayans, Babylonians, Greeks, Chinese, Egyptians, Romans, and Egyptians, used honey for both nutritional and therapeutic purposes. The only naturally occurring substance created from insects, honey has uses in industry, cosmetics, medicine, and nutrition. Honey is regarded as a healthy diet and is enjoyed by people of all ages, including men and women. Honey can be kept unopened at room temperature in a dry place and doesn't need to be refrigerated because it never goes bad. Honey's high fructose content (it's 25% sweeter than table sugar) has made it a popular natural sweetener since ancient times. Furthermore, honey is becoming a more and more common ingredient in drinks. These days, a wide range of unidentified activities are suggested in

general periodicals, journals, and brochures promoting natural products, along with information on the use of honey as a remedy for numerous human ailments. Research suggests that honey has a number of positive health impacts, including effects on the neurological system, gastrointestinal tract, respiratory system, antimicrobial, anti-inflammatory, and antidiabetic[18].

#### **Tragacanth:**

The removal or decrease of "additives" from food and other health-related products is highly desired by consumers and regulatory bodies, which has led to a rise in interest in natural macromolecules or hydrocolloids like gums. Gum Tragacanth (GT) is a versatile exudate gum that possesses distinct properties for thickening, emulsifying, increasing viscosity, stabilizing, gelling, and structuring. A class of polysaccharides known as gums can be found in plants (such as trees, shrubs, seeds, and tubers), algae (such as red and brown seaweeds), and microorganisms. In reaction to mechanical damage or biological attacks, certain trees and shrubs release sticky secretions called gums, which often solidify to seal the wound and provide protection. Depending on the water's availability and their chemical makeup, they mainly dissolve easily in it and can result in a gel, colloidal solution, dispersion, or viscous suspension. For centuries, they have been employed in a wide range of industries (such as food, medicine, cosmetics, textiles, agro-chemicals, and lithography) as thickeners, gelling agents, moisture-controlling agents, stabilizers, emulsifiers, dietary fiber, fat substitutes, and even film-forming agents. There are consumer and/or regulatory organization limits on the use of additives, especially synthetic ones, in the majority of the aforementioned industries, particularly in the food industry. Gum Tragacanth, a natural gum, is becoming more and more popular as a solution to these issues[19].



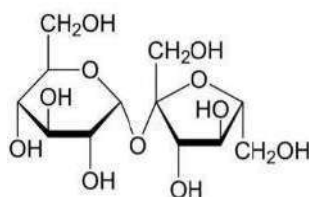
## Sugar:

Sugars have a variety of significant functions in our diet as carbs. In addition to serving as a source of calories, they also carry out a number of crucial technical tasks in both processed and home-cooked meals. Sugar has a number of other uses besides being an energy source and a precursor to the synthesis of triglycerides, lactate, and glycogen. Firstly, the component glucose has the **Structural formula for Table Sugar:**

ability to stimulate insulin secretion as well as the incretin pathway, which in turn stimulates insulin secretion. Furthermore, sugar activates specific taste cells in the soft palate and on the dorsal side of the tongue[20].

**Molecular formula of Table Sugar:**  
**C<sub>12</sub>H<sub>22</sub>O<sub>11</sub>**

**Molecular Mass of Sucrose (Table Sugar)**  
**C<sub>12</sub>H<sub>22</sub>O<sub>11</sub> = 342 g / mol**



**Fig. No. 6 Structure of Sugar**

## Methods:

### Decoction of Beetroot

One beetroot were taken and outer peel was removed. Then it cut into small pieces and added

in 100 ml water. Then heated slowly to get extract. The extract was filtered and cool down. From Whole extract 18 ml of solution measured.



**Fig. No. 7 Beetroot Extract**

### Orange peel extract

1. Wash the oranges thoroughly to remove any pesticides or wax.
2. Use a grater or peeler to remove the orange zest (the outer colored part of the peel). Avoid the white pith as it is bitter.
3. Spread the peels on a tray and allow them to air dry for a few days in a well-ventilated area. This step is optional but can enhance the flavor and shelf-life of the extract.
4. Place the orange peels in a clean jar.
5. Pour high-proof alcohol over the peels until they are fully submerged.
6. Seal the jar tightly and shake it gently.
7. Store the jar in a cool, dark place for at least a week. Shake the jar once a day to help the extraction process.
8. After the infusion period, strain the liquid through a strainer or cheesecloth into a clean bowl to remove the peels.
9. Press the peels to extract as much liquid as possible.
10. Pour the strained extract into a dark glass bottle to protect it from light.

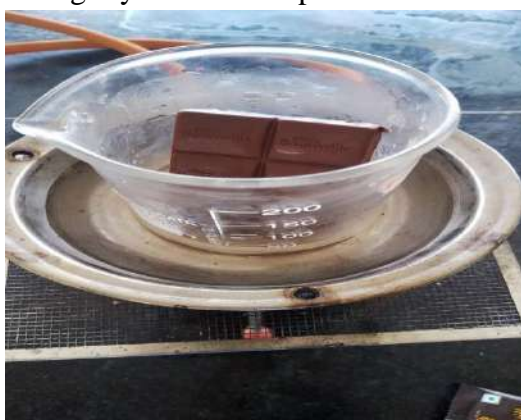




**Fig No. 8 Orange peel and orange extract**

**Preparation of chocolate base**

60 gm dark chocolate weighed properly. Place the solid dark chocolate in beaker and melt in water bath by continues stirring. Turn off the burner after completion of melting of dark chocolate. Allow it to cool slightly at room temperature.



**Fig. No. 9 Melted chocolate**

**Preparation of Tragacanth**

Solution Weigh 5 gm of tragacanth and add into 100 ml distilled water with continues stirring until

tragacanth get completely dissolve in water. Then measure the 15 ml of solution take away in measuring cylinder.

**Preparation of sugar powder**

Crystalline form of table sugar is prepared in powder form by grinding using mixer grinder.

**Batch 1 (F1)**

Add the 12 ml beetroot extract and 8 ml orange extract in melted dark chocolate with continues stirring. Then add 7 gm table sugar (powder form) and honey (Q.S). Last but not the least add slowly tragacanth solution of 12 ml in melted base. Mixed all the ingredients well and allow it to room temperature for cooling. Then pour the mixture into mould and kept into refrigerator for freezing for around 6 to 7 hours.

**Batch 2 (F2)**

Add the 15 ml beetroot extract and 10 ml orange extract in melted dark chocolate with continues stirring. Then add 8 gm table sugar (powder form) and honey (Q.S). Last but not the least add slowly tragacanth solution of 15 ml in melted base. Mixed all the ingredients. well and allow it to room temperature for cooling. Then pour the mixture into mold and kept into refrigerator for freezing for around 6 to 7 hours.



**Fig. No. 10 Chocolate filled in the mould**

**Table no. 3 Ingredients used in formulation**

Name of ingredients	Quantity taken (F1)	Quantity taken (F2)	Role
Beetroot extract	12 ml	15 ml	Antioxidant, immune booster, prevent cardiac health
Orange extract	8 ml	10 ml	Vit. C, antioxidant
Dark chocolate	60 gm	60 gm	Antioxidant
Sugar	7 gm	8 gm	Sweetening agent

Tragacanth	12 ml	15 ml	Solidifying agent
Honey	Q. S.	Q. S.	Emulsifier

## Evaluation tests Organoleptic properties

**Table no. 4: organoleptic properties**

Parameters	Test	Control
Color	Brown	Brown
Odor	Chocolaty	Chocolaty
Taste	Slightly bitter	Slightly bitter
Appearance	Glossy	Glossy

pH- The pH of chocolate formulation was done by **Bloom test** using pH meter and the result was found to be pH=6.4.

**Table no. 5: Bloom test**

Test	Results
Fat bloom	No
Sugar bloom	No

## Stability study

Stability study of chocolate is performed to clarify the stability of prepared chocolate.

**Table no. 6: Stability study**

Parameters	Storage conditions
Colour, Odor, Taste,	3-9°C
Appearance	Smooth

## RESULT AND DISCUSSION

### Results

#### Results of evaluation tests performed for prepared chocolate

#### Organoleptic properties

**Table no. 7: Organoleptic properties for F1**

Parameters for F1	Test	Results
Colour	Brown	Brown
Odour	Chocolaty	Chocolaty
Taste	Slightly bitter	Slightly bitter
Appearance	Glossy	Glossy

**Table no. 8: Organoleptic properties for F2**

Parameters for F2	Test	Results
Colour	Brown	Brown
Odour	Chocolate	Chocolaty
Taste	Slightly bitter	Slightly bitter
Appearance	Glossy	Glossy

Organoleptic properties are performed and found to be present. These are sensory properties. Those that can be detected by the sense organs. For foods,

it is used particularly of the combination of taste, texture, and astringency and Aroma (perceived in the nose).



pH

**Table no. 9: pH of F1 and F2**

Batches	pH
F1	6.4
F2	6.7

**pH-** The pH of chocolate formulation was done by using pH meter and the result was found to be pH=6.4 (B1) and 6.7 (B2). B2 has more pH than B1.

**Bloom test**

**Table no. 10: Bloom strength for F1 and F2**

Test	Results (F1)	Results (F2)
Fat Bloom	No	No
Sugar Bloom	No	No

Bloom is a test to measure the strength of a Chocolate. The test determines the weight in Grams needed by a specified plunger to depress the surface of chocolate without breaking it at a specified temperature. There is no blooming was Observed in any formulation, in both the batches.

**Stability study**

**Table no. 11: Stability study for F1 and F2**

Parameters Colour, odour, taste, appearance	Storage conditions	At the time of preparation Brown, chocolaty, slightly bitter, glossy	After 25 days
F1	3-9°C	Present	Present
F2	3-9°C	Present	Present

**CONCLUSION:**

We develop herbal chocolate having malnutritional property show significant effect. In the present study, development of nutritious chocolate having antioxidant activity was carried out. Aqueous extract of Beetroot with dark chocolate as chocolate base rich in antioxidant was prepared and phytochemical analysis was carried out to check the presence of desired compounds that Shows the acceptable results. From above study, we concluded that the chocolate provides smooth and creamy texture to the formulation and are good for masking the unpleasant taste, good oral drug delivery System to gives therapeutic effect. Chocolate is rich in various health benefits

with antioxidant property, vitamin c in rich, good for cardiac health. Prepared and evaluated for general appearance, dimension, hardness, blooming test, pH, drug content determination and physical stability.

**FUTURE SCOPE**

The development of a nutritional and antioxidant-rich chocolate incorporating beetroot, orange, dark chocolate, honey, and tragacanth gum presents a promising frontier in the functional food and nutraceutical sectors. This innovative product aligns with the growing consumer demand for healthier snack options that offer both indulgence and health benefits. Health Benefits Research: The individual components of this chocolate,

particularly beetroot and orange, are rich in antioxidants and essential nutrients. Future research can focus on quantifying the specific health benefits of these ingredients when combined, including their impact on cardiovascular health, cognitive function, and anti-inflammatory properties. Clinical trials could establish the efficacy of this product in improving overall health metrics. Market Demand and Consumer Acceptance: As consumers become more health-conscious, there is a rising demand for functional foods. Market studies can evaluate consumer acceptance of this novel chocolate, focusing on taste, texture, and perceived health benefits. Understanding consumer preferences can guide product refinement and marketing strategies to ensure widespread adoption. Nutritional Profiling and Labeling: Detailed nutritional profiling of the chocolate can highlight its macro and micronutrient content, providing transparency and aiding consumers in making informed choices. This includes profiling the antioxidant levels, vitamin content, and caloric value. Effective labeling can enhance the product's appeal to health-conscious consumers.

#### **Formulation and Stability Studies:**

Investigating the stability and shelf life of this chocolate formulation is crucial. Research can delve into the interactions between the natural ingredients and their impact on the product's texture, taste, and longevity. This includes optimizing the concentration of honey and tragacanth gum to achieve the desired consistency and shelf stability.

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