

Formulation and Evaluation of Herbs Infused Chocolate

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ABSTRACT

The global consumption of chocolate at different ages and for different purposes served as the impetus for this study. The high demand for chocolate in the market has resulted in the potential for adulteration of chocolate products to meet this demand. This research delves into the innovative application of herbal chocolates, a delightful fusion of traditional enjoyment and holistic well-being. The blending of herbal ingredients with the luxurious texture of chocolate has given rise to a new category of confectionery that not only satisfies sweet cravings but also offers potential health advantages. Our investigation covers the broad area of herbal chocolates, analyzing the inclusion of herbs, spices, and botanical extracts into chocolate recipes. These chocolates, composed of various ingredients with numerous medicinal properties, aim to nourish the body without any adverse effects. Cocoa powder and cocoa butter possess antioxidant properties, while dark chocolate offers properties beneficial for treating type 2 diabetes mellitus. In herbal chocolate, liquorice powder serves as the primary sweetening agent, boasting antioxidant and has antiviral and anti-diabetic properties. Furthermore, cinnamon and cardamom, beyond their roles as flavour enhancers, also offer medicinal benefits such as lowering blood pressure and aid in weight loss with regular consumption. What distinguishes herbal chocolate from other chocolates is its formulation that is free from synthetic preservatives and emulsifying fats, which can lead to long-term side effects. Instead, herbal chocolate employs COCOA BUTTER as a natural emulsifier and ROSEMARY'S EXTRACT as a preservative. This unique aspect transforms herbal chocolate into more than just a daily snack, instead serving as a slow infusion of medicinal values into the body, contributing to overall health. Thus, herbal chocolate is classified as a "functional food," as described in the abstract of this research article.

KEYWORDS: Herbal Chocolate, Natural Emulsifier, Alzheimer's, Herbal Infusion, Hair Growth.

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INTRODUCTION:

The term "CHOCOLATE" finds its roots in the word 'coca.' The history of chocolates dates to 400 AD [1]. It is crafted from the seeds of the coca plant known as '*Theobroma cacao*.' These seeds boast a rich concentration of antioxidants and essential minerals. Chocolate is created through a series of steps including seed roasting, fermentation, and various physiochemical processes, ultimately yielding cocoa powder and cocoa butter, depending on the specific preparation and extraction techniques employed [2].

Chocolate is abundant in phytochemicals such as phenylethane (Figure 1), flavonoids, methylxanthines, aliphatic alcohols, sterols, and more. Phenylethylamine, known as the 'love drug', occurs naturally in the brain and is produced when individuals experience love. PEA, a type of amphetamine present in the brain, acts as a natural stimulant [3]. It aids in hormone production, fosters feelings of optimism and pleasure, and elevates dopamine levels along with other neuroreceptors [4].

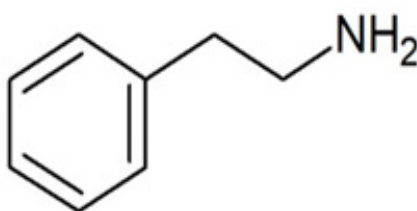


Figure 1. Phenylethylamine.

Chocolate delivery system

Chocolate is a versatile food, capable of blending to create entirely unique taste and texture experiences. It is a highly sophisticated and versatile delicacy that, due to its anhydrous nature, can be combined to trigger the hydrolysis of active ingredients that are sensitive to water. Chocolate is often utilized as a delivery system for active compounds, owing to its ability to mask the less palatable flavours of these compounds and transform otherwise unattractive, granular compositions of active ingredients into smooth and creamy textures. This makes the chocolate drug delivery method particularly beneficial, especially for children and younger individuals [5].

The chocolate drug delivery technology offers two significant advantages: Potential bypassing of first-pass effects and prevention of pre-systemic elimination within the gastrointestinal tract. Additionally, due to its anhydrous properties, chocolate resists microbial growth and degrades water-sensitive active ingredients. Chocolate stands out as an excellent delivery system for active compounds across a range of applications [6].

MATERIALS AND METHODS

CHOCOLATE

Botanical Name: *Theobroma cacao*

Synonyms: Cocoa tree, Cacao tree

Morphological Characteristics:

Plant: *Theobroma cacao* is a small evergreen tree that typically grows to a height of 4-8 meters (13-26 feet).

Leaves: The tree has broad, glossy green leaves that are oblong in shape and arranged alternately on the branches.

Flowers: it produces small, delicate flowers directly on the trunk and older branches. These flowers are white to pinkish in colour and have a characteristic odour.

Roots: The roots of the cacao tree are shallow and wide-spreading, helping to anchor the tree in the soil and absorb nutrients and water.

Chemical Constituents:

Flavonoids: Cacao beans contain a variety of flavonoids including: Catechins, Epicatechins

Procyanidins, Anthocyanidins.

Theobromine: This is a bitter alkaloid that is responsible for much of the stimulant effects in chocolate.

Caffeine: Though present in smaller amounts compared to theobromine, caffeine contributes to the stimulating properties of chocolate.

Polyphenols: These compounds act as antioxidants and are found in abundance in dark chocolate.

Fatty Acids: Cocoa butter, extracted from cocoa beans, contains a mix of fatty acids such as stearic acid, oleic acid, and palmitic acid.

Phenylethylamine: Known as the “love drug,” PEA is a compound that is said to increase feelings of pleasure and well-being.

Anandamide: It is called the “bliss molecule,” anandamide is a neurotransmitter found naturally in cacao that can promote feelings of happiness and relaxation [7].

DARK CHOCOLATE

Dark chocolate has long been utilized in various medical preparations due to its natural properties. One of its key attributes is its antioxidant capacity. The primary antioxidant phytonutrient found in cocoa beans is polyphenols. Among the most abundant flavonoids in cocoa powder are catechins and anthocyanins. Consumption of chocolate has been linked to a decrease in cardiovascular activity, earning it the designation of a functional food. Notably, among the different types of chocolate, dark chocolate is favoured for its elevated levels of flavonoids and polyphenols [8].

More over the dark chocolate contains pure cocoa extraction and white chocolate contains the milk & derivatives of milk, this leads to contamination of white chocolate when compared to dark chocolate. It contains lower amount of fats and sugar content than other chocolate types. It possesses the medicinal properties but also contains high shelf-life period than other types. With this profound reason dark chocolate can be used in herbal preparations.

WHITE CHOCOLATE COMPOUND

White chocolate is a confectionary delight known for its creamy, sweet taste and smooth texture. Unlike traditional chocolate, it contains no cocoa solids, but is instead made from cocoa butter, sugar, milk solids, and often vanilla for flavour. The absence of cocoa solids gives white chocolate its distinct ivory colour and milder flavour profile, with notes of vanilla and caramel. Its creamy texture melts smoothly on the tongue, making it a luxurious treat for those with a sweet tooth. White chocolate is a versatile ingredient, lending its richness to desserts like mousses, ganache's, and truffles, as well as enhancing the flavour of baked goods, beverages, and confections. Whether enjoyed on its own or as part of a decadent dessert, white chocolate offers a delightful

indulgence for those seeking a sweet and creamy treat.

COCOA BUTTER

It is commonly called as Theobroma oil, an edible fat taken from the cocoa plant bean. It is another cocoa extract that helps the chocolate to maintain its texture, flavour & aroma long-lasting and makes the powder mixed (adhesive agent). It contains high contribution of saturated fats along with oleic acid in each triglyceride. The cocoa butter is prepared by roasting and prepared as cocoa nibs. Then they are ground to form the cocoa liquor which is further pressed to separate the cocoa butter from the non-fat cocoa solids. Thus, the prepared cocoa butter is further used in the chocolate preparation.

Cocoa butter is used as main ingredient in preparation of all types of chocolates such as dark/white/milk or any other form, as the melting point of cocoa butter plays a major key role apart from other vegetable oils. Hence, using this makes the chocolate non sticky to finger and stay as solid even on exposure to room temperature.

Melting the cocoa butter in chocolate & then allowing it to solidify without tempering, leads to the formation of unstable polymorphic forms of cocoa butter. That can easily happen when the chocolate bars are allowed to melt in a hot room and leads to the formation of white patches on the surface of chocolate called fat bloom / chocolate bloom [9]. The cocoa butter is used as an emulsifier in this preparation.

The cocoa butter has many medicinal uses as it helps in removal of wrinkles, smooth scars, and other marks on the skin. It may improve the blood flow to skin and protect skin against damage from the sun. Many moisturizers have been prepared by using cocoa butter because of its high fat content. Growing body of scientific evidence is becoming available to support that cocoa components with antioxidants and anti-inflammatory activities contribute to endogenous photoprotection and are crucial for the maintenance of skin health [10].

LIQUORICE

The sweetening agent of herbal chocolate-popularly known as “Abhidharma” in Telugu, liquorice is a natural sweetener that enhances the hypoglycaemic effect in diabetic individuals seeking sweetness.

Botanical Name: *Glycyrrhiza glabra*

Synonyms: Licoricey, Sweet Root

Morphological Characteristics

Plant: Herbaceous perennial with compound leaves.

Roots: Thick, fibrous, and yellowish-brown on the exterior with a sweet taste.

Chemical Constituents

Glycyrrhizin: The primary sweet-tasting compound responsible for the characteristic flavour.

Flavonoids: Various compounds contributing to its medicinal properties.

Coumarins: Present in small amounts.

Uses:

Medicinal: Traditional uses for its anti-inflammatory and expectorant properties.

Cosmetics: Used in skincare products for its soothing properties.

Flavouring: Commonly used as a sweetener in confectionery and beverages

Due to possessing of the multiple uses the liquorice gives additional medicinal activity to the herbal chocolate and it makes the chocolate consumption safer even after prolonged usage. Liquorice is one of the most effective herbal medications for reducing toxicity and increasing the efficacy of other herbal medicines when used together [11].

CINNAMON: A flavouring agent of herbal chocolate with potential health benefit like anti-inflammatory agent.

Botanical Name: *Cinnamomum verum*

Synonyms:

Ceylon Cinnamon: *Cinnamomum zeylanicum*

Cassia Cinnamon: *Cinnamomum aromaticum*

Morphological Characteristics:

Ceylon Cinnamon: Thin, papery bark with a mild flavour.

Cassia Cinnamon: Thicker, rougher bark with a stronger, spicier taste.

Leaves: Aromatic, opposite or alternate.

Flowers: Small and inconspicuous, clustered.

Microscopic Characteristics:

Ceylon Cinnamon: Thin, single-layered inner bark cells.

Cassia Cinnamon: Thick-walled stone cells in the bark.

Chemical Constituents:

Cinnamaldehyde: Primary compound responsible for the characteristic flavour.

Eugenol: Present in varying amounts, contributing to aroma

Coumarin: Found in higher levels in Cassia cinnamon, potentially harmful in large quantities

Uses:

Medicinal: Traditional use for various health benefits, including anti-inflammatory properties.

Fragrance: Aromatic component in perfumes and potpourri.

Culinary: Flavouring agent in both sweet and Savory dishes.

It has anti-microbial, anti-parasitic, anti-oxidant and free radical scavenging properties [12].

Cinnamon, primarily focused as a flavouring agent, possesses medicinal properties that enhance the medicinal values of herbal chocolate.

CARDAMOM: An additional flavouring agent to herbal chocolate.

Botanical name: *Elettaria cardamom*

Synonyms: Cardamon, Elaichi

Morphological Characteristics:

Plant: Perennial herb with long, reed-like stems.

Leaves: Large, lance-shaped, and arranged alternately.

Flowers: Small, yellow-green with Violette, borne on along panicle.

Fruit: Small, green to pale yellow capsules containing aromatic seeds.

Microscopic Characteristics:

Seeds: Oval, small, with a distinct hilum.

Chemical Constituents:

Essential Oils: Primary constituents like cineole, terpinene, and linalool

Eugenol: Aromatic compound contributing to the characteristic fragrance.

Terpenes: Found in varying amounts.

Uses:

Medicinal: Traditional use for digestive and respiratory ailments.

Culinary: Widely used as a spice in both sweet and Savory dishes.

Flavour: Used in beverages, desserts, and perfumery.

Cardamom has been incorporated into many medicines due to its efficacy in treating digestive and respiratory problems. It also exhibits antimicrobial activity [13].

Due to such properties, adding this to herbal chocolate gives, not only flavour but also aids in controlling air borne disorders.

ROSEMARY OIL: Preservative of the herbal chocolate.

As the preparation consists of an emulsifier, there is a need to add a preservative agent to maintain shelf life of the product. Rosemary oil is added to Herbal chocolate preparation as a natural preservative agent to possess longer shelf-life period than normal preparations. Eventually this extract also shows extra medicinal properties along with its main action.

Botanical Name: *Rosmarinus officinalis*

Morphological Characteristics:

Plant: Ever green shrub with needle-like leaves.

Leaves: Linear, aromatic, and dark green.

REQUIREMENTS:(For 200g chocolate bar)

Ingredients:

S.No	Ingredients	Quantity to be taken
1	Dark chocolate compound	100gms
2	White chocolate compound	100gms
3	Liquorice (finely chopped or ground)	3gms
4	Cinnamon powder	0.5gms
5	Cardamom powder (flavouring agent)	0.5gms
6	Rosemary powder (Extra flavouring agent and a natural preservative)	1gm
7	Cocoa butter	5gms

Equipment:

- Double boiler or microwave-safe bowl.
- Chocolate Moulds.
- Whisk or spatula.

Flowers: Small, blue to violet, clustered.

Microscopic Characteristics:

Trichomes: Presence of glandular trichomes on the leaves, contributing to the characteristic aroma.

Chemical Constituents:

Rosmarinus Acid: A polyphenolic compound with antioxidant properties

Essential Oil: Rich in Compounds like following.

Uses:

Medicinal: Traditionally used for various health benefits, including improved digestion & memory.

Cosmetics: Aromatic component in perfumes and skincare product.

Culinary: Flavouring agent in cooking, especially in Mediterranean cuisine.

Rosemary extract has been widely used in folk medicine to treat several diseases, including headaches, stomach aches, rheumatic pain, spasms, and memory improvement. Hence, using rosemary oil in herbal chocolate amplifies the medicinal values that are more deficient in our daily diet [14].

FORMULATION METHOD:

The preparation of herbal chocolate was carried out as described in book of [8].

STEPS FOR PREPARATION:

- 1. Procurement of Ingredients:** All the ingredients are measured accurately.



Figure 2. Ingredients.

- 2. Melting Chocolate compounds**

In a double boiler or microwave-safe bowl, the dark and white chocolate compounds are melted until it becomes a smooth liquid, and stirred continuously to avoid lumps.



Figure 3. Melted chocolate compound.

- 3. Incorporation of Licorice**

Licorice powder is added to the mixture. The quantity is adjusted based on preferred sweetness.

- 4. Infusion of Herbs and Spices**

Rosemary extract, cinnamon, and cardamom are added to the mixture and stirred thoroughly to distribute the flavours evenly.

- 5. Taste and adjust**

Chocolate mixture is tasted and the quantity of licorice, spices or any other ingredient is adjusted to achieve the desired flavour profile.

- 6. Pour into Molds**

The herbal chocolate mixture is poured into Chocolate moulds. Moulds are gently tapped to remove air bubbles.



Figure 4. Chocolate moulds.

7. Set and Chill

Moulds are placed in the refrigerator to allow the chocolate to set. This typically takes few hours.

8. Unmould and Enjoy

Once the chocolate is completely set, the chocolates carefully unmoulded. They are now ready.



Figure 5. Prepared herbal chocolates.

HOMELY PREPARATION OF CHOCOLATE (INFUSE):

- 1) In a double boiler or microwave-safe bowl, melt 100gm of white chocolate compound and dark compound until they form a smooth liquid.
- 2) It is regularly churned to prevent lumps.
- 3) 3g of licorice powder is added to the mixture. The quantity is adjusted based on the desired sweetness. A sprinkle of salt is added to enhance the sweetness.

- 4) Then, 1gm of cinnamon and cardamom powder are gradually added to the mixture.

- 5) Pour the chocolate concoction into the molds and freeze for 30 minutes.

Therefore, the organic chocolate is made at home. Measurement of ingredients can be made according to preferences.



Figure 6. Homemade Formulated Herbal Chocolates.

EVALUATION PARAMETERS:**1) ORGANOLEPTIC PROPERTIES**

Parameters to check	Result
Colour	Brown
Odour	Chocolaty
Taste	Sweet
Mouth Feel	Smooth and pleasant
Appearance	Glossy

2) BLOOMING EFFECT

Fat bloom: When a thin layer of fat crystals forms on the surface of the chocolate formulation, it will cause the chocolate to lose its gloss and a soft white layer will appear, giving the finished article an unappetizing look. Fat bloom is caused by the recrystallization of the fats and/or a migration of a filling fat to the chocolate layer. Storage at a constant temperature will delay the appearance of fat bloom.

Sugar bloom: This is a rough and irregular layer on top of the chocolate formulation. Sugar bloom is caused by condensation (when the chocolate is taken out of the refrigerator). This moisture will dissolve the sugar in the chocolate. When the water evaporates afterwards, the sugar recrystallizes into rough, irregular crystals on the surface. This gives the chocolate an unpleasant look. Each sample was subjected to treatment cycles comprised (1) 30°C for 11 hours, (2) temperature shifting for 1 hour, (3) 18°C for 11 hours, and (4) temperature shifting for 1 hour. Following the 11-hour interval at 18°C, the test chocolate formulation was examined to determine if blooming had occurred.

3) STABILITY

The stability studies of formulated formulation were carried out at 25/75(°C/RH) and 2-8°C for one month. The chocolate was packed in aluminium foil paper and the organoleptic properties (colour, odour, taste, mouth feel and appearances) were evaluated for assessing the stability of the prepared formulation.

RESULT AND DISCUSSION**1) ORGANOLEPTIC PROPERTIES**

Parameters	Result
Colour	Brown
Odour	Chocolaty
Taste	Sweet
Mouth Feel	Smooth and pleasant
Appearance	Glossy

2) BLOOMING TEST

Test	Result
Fat bloom test	0
Sugar bloom test	0

3) STABILITY: Test group was selected for stability study

Parameters	Storage condition	At the time of preparation
Colour, Odour, Taste,	2-8 °c	Brown, chocolaty, slightly
Mouthfeel, Appearance		bitter, smooth, glossy

CONCLUSION

This research paper concludes that, unlike chocolates laden with artificial additives, herbal chocolate presents itself as a health-promoting alternative, leveraging ingredients such as dark chocolate and cocoa butter, both of which are known for their antioxidant properties and contribute to wrinkle reduction. Furthermore, using licorice as a sweetener in herbal chocolate gives extra health benefits by helping to regulate blood glucose levels. These herbal infusions not only improve flavor but also help to general well-being when eaten on a daily basis. Notably, the inclusion of flavoring components such as cinnamon and cardamom imparts additional medicinal characteristics, such as anti-inflammatory effects, hence enhancing the health profile of herbal chocolate. Furthermore, the use of rosemary extract as a preservative emphasizes the beneficial characteristics of herbal chocolate. Furthermore, the use of rosemary extract as a preservative emphasizes the beneficial properties of herbal chocolate, increasing its shelf life while also helping to reduce skin aging. The combination of these herbal ingredients in herbal chocolate production enhances its therapeutic properties, making it into a powerful functional food or nutraceutical. As we go farther into the area of culinary science, the discovery and use of herbal chocolate represents a move toward health-conscious consumption. This study sheds light on the hopeful future of herbal chocolate, portraying it not only as a delicious treat but also as a means of improving wellbeing and vitality.

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