

## “Formulation and Evaluation of Anti-Diabetic Herbal Chocolate”

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### ABSTRACT:

Chocolate is often considered the most beloved food among children, whereas medicine is typically viewed as unpleasant. The aim of this study is to develop and design a chocolate product that serves as both a nutritious treat and a supplement with antioxidant and anti-cancer properties. Chocolate is typically made from cocoa combined with fat and finely powdered coconut sugar to create a solid confectionery. Psidium guajava, a medicinal herb, offers various health benefits such as antitussive, antioxidant properties, heart disease prevention, and skin treatment. Black sesame, known for its ability to improve blood pressure and act as an anti-aging agent, was also incorporated. This study focuses on formulating chocolate with aqueous extracts of black sesame and guava, which provide antitussive and anti-diabetic effects. Chocolate, a versatile food, can be mixed with different ingredients to create various flavors and textures. Therefore, the goal of this study is to prepare a chocolate formulation containing black sesame and guava, aiming to enhance patient compliance and therapeutic benefits.

**KEYWORDS:** Black sesame seed, Antioxidant, Psidium guajava (guava)

### I. INTRODUCTION:

Chocolate is a versatile food that can be combined in various ways to create diverse tastes and textures. It is an ideal drug delivery system, especially for children and young people. The human senses identify five basic tastes: sweet, bitter, sour, salty, and savory. Among them, sweet taste is the most pleasurable, and its primary role is to detect high-calorie sugars for energy intake. Herbal formulations refer to dosage forms containing one or more herbs in specific amounts, providing nutritional and cosmetic benefits for diagnosing, treating, and alleviating conditions.

Chocolate serves as an excellent medium for delivering active ingredients due to its unique

properties. This study aims to prepare a herbal chocolate formulation with antioxidant, anti-cancer, and anti-aging benefits. Chocolate, which is rich in flavonoids and antioxidants derived from cocoa, is a highly adaptable and sophisticated food. It can be mixed and matched to produce various sensory experiences, making it an ideal candidate for developing a nutritious and therapeutic product. The main objective of this research is to create a natural, healthy chocolate as a nutritional supplement.

Medicated chocolate formulations are increasingly used to address health concerns and enhance patient compliance. The study evaluates several aspects of the chocolate mixture, including organoleptic characteristics, pH, blooming test, preliminary phytochemical screening, and hardness. A stability study is also conducted to assess any significant changes in the chocolate's physical properties over time.

Chocolates are solid suspensions made from sugar, cocoa, and sometimes milk, with a fat content of about 70%. Cocoa solids are extracted from Theobroma cacao beans, which come in varieties such as Forastero, known for their small, flat, purple beans, and Criollo, valued for its flavor and disease resistance. The main types of chocolate—dark, milk, and white—vary in cocoa content, milk fat, and cocoa butter, resulting in different proportions of carbohydrates, fats, and proteins.

Chocolate production methods differ worldwide, influenced by consumer preferences and regional practices. The lipid composition of chocolate, which affects its texture and melting properties, is crucial to its flavor. Chocolate contains a mix of saturated stearic and palmitic acids, along with monounsaturated oleic acid. At room temperature (20-25°C), chocolate remains solid, but it melts at 37°C, creating a smooth suspension of solid particles in cocoa butter and milk fat. This helps limit the overall lipid content.

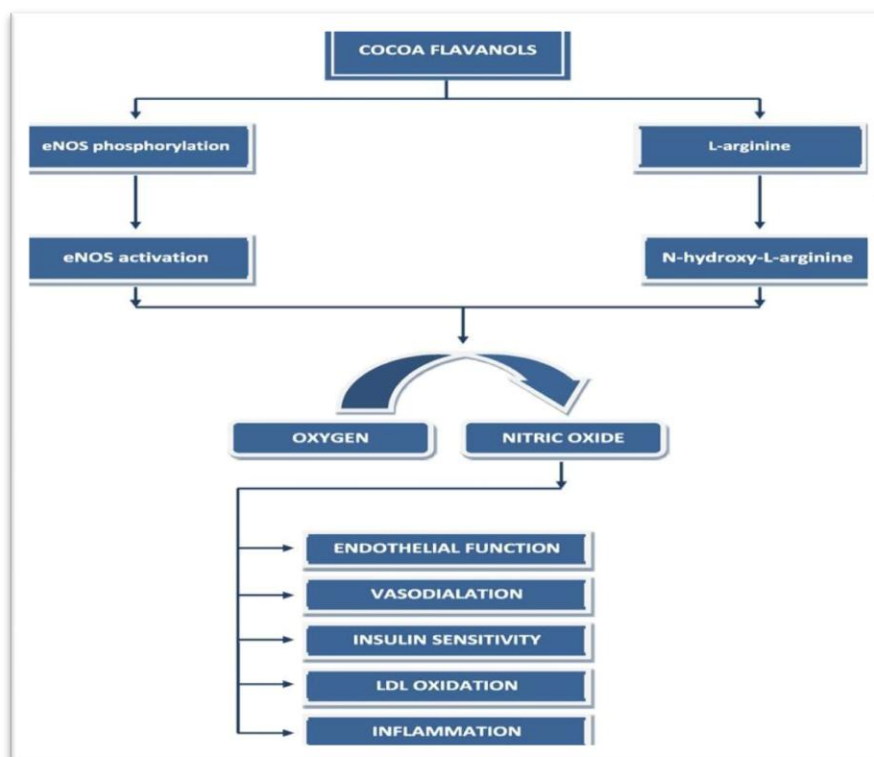


**Fig No.1:Image of Chocolate**

**MECHANISM:**

Cocoa is recognized as a natural source of antioxidants, which are compounds that neutralize free radicals, helping to protect cell membranes, safeguard DNA, and prevent the oxidation of LDL cholesterol. This oxidation process can contribute to the development of atherosclerosis and plaque buildup in artery walls. The antioxidant properties of cocoa are attributed to procyanidins and their precursors, epicatechin and catechin, which prevent LDL oxidation. Studies have shown that dark chocolate and cocoa can reduce LDL oxidation while also raising HDL cholesterol levels.

Catechins, which are phytochemical compounds found in various plant-based foods and drinks, are abundant in dark chocolate. For example, dark chocolate contains 12 mg of catechin per 100 grams and 41.5 mg of epicatechin per 100 grams. The consumption of catechins has been linked to several health benefits, including increased plasma antioxidant activity, improved bronchial artery dilation, enhanced fat oxidation, and resistance to LDL oxidation. Epicatechin is considered a key bioactive compound in cocoa and other flavanol-rich foods and beverages.



**Fig no. 2: Mechanism of antioxidant property of chocolate**

**Therapeutic Benefits of Chocolate:**

- Diuretic Properties:** Theobromine, a compound found in chocolate, has diuretic effects, helping to treat fluid retention (edema) by promoting the elimination of excess water and salts through urine. This can also contribute to reducing high blood pressure caused by fluid buildup in connective tissues.
- Vasodilation:** Theobromine helps dilate blood vessels, which can improve blood flow and, as a result, reduce blood pressure. This vasodilation effect supports cardiovascular health.
- Cardiac Function Improvement:** Theobromine has long been recognized for its ability to enhance heart function. According to the American Journal of Clinical Nutrition, it can be beneficial in treating heart conditions like arteriosclerosis, vascular diseases, angina, and hypertension.
- Tooth Decay Prevention:** Theobromine has been shown to help prevent tooth decay by inhibiting the growth of bacteria that cause dental cavities, making it useful in oral health.
- Anti-Cancer and Anti-Inflammatory Effects:** Dark chocolate is rich in antioxidants like flavonoids and polyphenols. These compounds help combat cancer and inflammation by neutralizing free radicals and suppressing abnormal cell division, thus reducing inflammation.
- Heart Disease Prevention:** Chocolate contains essential minerals such as iron, copper, magnesium, and zinc, all of which play a crucial role in preventing coronary heart disease (CHD) by supporting overall cardiovascular health.
- Reduced Food Cravings:** The bitter taste and high calorie and fat content of dark chocolate have been found to reduce cravings for sweet, salty, and fatty foods, making it a potential aid for appetite control.
- Antidepressant Effects:** Consuming chocolate stimulates the production of endorphins, neurotransmitters that promote a sense of well-being and help alleviate symptoms of depression. Additionally, chocolate is rich in serotonin, another neurotransmitter with known antidepressant properties.
- Memory Improvement:** Drinking hot chocolate has been shown to improve neurovascular coupling, the relationship between blood flow and brain activity, particularly in the white matter of the brain. This can enhance cognitive function and improve memory.

**II. EXPERIMENTATION**

**MATERIALS AND METHODS:**

SrNo.	Ingredient	Role
1.	Black sesame seed	Antioxidant, Improve blood pressure
2.	Psidium guajava	Anti-diabetic
4.	Cocoa butter	Solidifying Agent
5.	Honey	Emulsifier
6.	Clove	Anti-viral, Anti-inflammatory
7.	Dark chocolate	Antioxidant
8.	Rose flavor	Flavoring agent

**Table No. 1: Ingredient profile**

❖ **Collection of material:**  
 Black sesame seeds are collected from Market.

✚ **Extraction of herb drug (Guava):**  
 Sample Preparation of Guava leaf: Dried guava leaves for 1 week. Once dried, blend to a powder and sieve using a sieve #2. Guava leaf extraction: The sample extractio

n by maceration. Weigh as much as 50g of guava leaves, soaked in 150mL of ethanol with a concentration of 30%, 50% and 70% for 24 hours and then filtered to obtain a filtrate. Treatment was for 3 days. Filtrate obtained together then evaporated to obtain ethanol extracts. The evaporated extract was cooled in a desiccator before further a

nalysis.

**Extraction of Black Sesame Seed:**

Solvent-extraction was performed using 20g of ground seeds placed in a Soxhlet apparatus and extracted with n-hexane for 8 h. The organic phase was then concentrated under vacuum and dried for 5 min in a oven at 103±2 °C. Oil samples were stored at 4°C and protected from sunlight prior analysis.

**Chocolate formulation preparation:**

All of the materials were precisely weighed. Dark chocolate cocoa butter was heated in a separate beaker, then added to a powder combination and thoroughly combined to achieve a fine consistency. After that, an emulsifier, honey, was added and blended. Finally, the herbal medication extracts i.e. Crude extract of guava, and black sesame seed was precisely measured and put to the previously made chocolate. Before entering into the moulds, rose was added as a flavoring ingredient. The prepared chocolate containing herbal medication extract was then put into moulds and allowed to set overnight in the freezer and also prepared the control group.

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**Organoleptic Properties:**

Parameters	Test	Control
Colour	Brown	Brown
Odour	Chocolaty	Chocolaty
Taste	Sweet	Sweet
Mouthfeel	Smooth and pleasant	Smooth
Appearance	Glossy	Glossy

Table No. 2: Organoleptic Properties

**Formulation Table:**

SR NO.	INGREDIENT	QUANTITY	ROLES/FUNCTIONS
1	Black sesame seeds	50mg	Improve blood pressure, antioxidant
2	Psidium guajava extract	100mg	Antidiabetics
3	Clove	200mg	Anti-viral, Anti-inflammatory
4	Dark chocolate	80g	Antioxidant
5	Honey	15g	Emulsifier
6	Cocoa butter	50g	Solidifying agent
7	Rose flavor	5g	Flavoring agent

Table No. 3: Formulation Table

**1) Chemical Test:**

**➤ Test for Carbohydrate (Fehling's Test):**

To 1 ml of the solution, equal quantities of Fehling's solution A and B were added and heated. The formation of brick red precipitate indicates the presence of carbohydrates.

**➤ Test for Protein (Biuret Test/General Test):**

Take 3 ml of chocolate formulation; add 4% NaOH and few drops of 1% copper sulphate solution, violet color indicates presence of protein.

**➤ Test for amino acids (Ninhydrin test):**

3 ml of test solution was heated and 3 drops of 5% Ninhydrin Solution was added in boiling water and was boiled for 10 min. purple and bluish color indicates presence of amino acid.

**➤ Test for Saponins (Foam Formation)-**

Place 2 ml of chocolate formulation in water and this was added in test tube, shake well and stable foam is

form indicate the presence of saponins.

**pH:** 2gm of prepared chocolate was dissolved in 100ml of phosphate buffer solution and of the resulted solution was studied by digital pH meter with glass electrode.

**2) Blooming test:**

○ **Fat bloom:**

When a thin layer of fat crystals forms on the surface of the chocolate formulation. This 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 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. Rest chocolate formulation observed, after the step at 18°C for 11 hours, whether or not blooming has taken place.

**3) Stability-**

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

**III. RESULT AND DISCUSSION**

**1. Chemical test:**

Sr No.	Test	Observation	
1	Carbohydrates	Brick red ppt	+
2	Protein	Violet colour	+
3	Amino acid	Purple and bluish colour	+
4	Saponin	Foam formation	+

**Table No.4: chemical test of herbal chocolate**

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

**3. Blooming test:**

Test	Result
Fat Bloom	No
Sugar Bloom	No

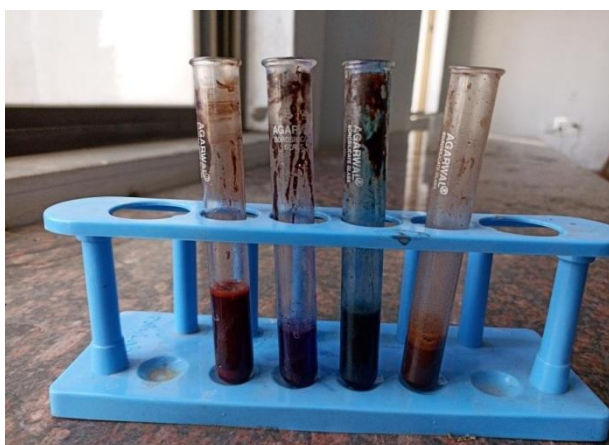
**Table No.5: Blooming test**

**4. Stability:** Test group selected for stability



Parameters	Storage condition	At the time of preparation	After one month
Colour, Odour, Taste, Mouthfeel, Appearance	2-8°C	Brown, chocolaty, slightly bitter, smooth, glossy	No change

**Table No. 6: Stability test**



**Figno3: Chemical test for herbal chocolate**



**Figno4: Blooming test**



**Figno5: Stability test**



**Figno6: Chocolate formulation**

#### IV. CONCLUSION

In the present study, development of Herbal Chocolate having antioxidant activity was carried out. Aqueous extract of guava leaves 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 gives therapeutic effect.

## V. SUMMARY

As a result of the previous findings, the sweetening properties, pH, and stability profile are all deemed satisfactory. Additional in vivo studies could be conducted using a cognitive model or another suitable animal model. The herbal extracts from black sesame seeds and guava were successfully incorporated into chocolate formulations. The organoleptic characteristics of chocolate are ideal for masking undesirable flavors often associated with certain active ingredients while providing a smooth, creamy texture to the active agent compositions. Consequently, chocolate formulations offer an attractive method for administering medications orally. The herbal extracts used within the specified dose range are safe for consumption and can be easily ingested.

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