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## Design, Development and Evaluation of Herb-Vita Chocolate

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### ABSTRACT

This study aims to develop a nutritious chocolate formulation incorporating herbal ingredients to enhance health benefits while maintaining consumer appeal. Chocolate, widely favored by children, serves as an excellent medium for delivering essential nutrients. Both dark and white chocolates, known for their rich antioxidants and flavor, form the base of the formulation. To enhance its functional value, nutrient-dense ingredients such as moringa, beetroot, almonds, thyme, cardamom, and Tulsi were incorporated. Six formulations (F1, F2, F3, F4, F5, F6) were developed with varying ingredient compositions and evaluated based on taste, texture, aroma, consistency, stability, and nutritional content. Among these, F4 (dark chocolate) and F6 (white chocolate) emerged as optimized formulations, achieving an ideal balance between sensory appeal, stability, and enhanced nutritional value. This study highlights the potential of integrating traditional herbal remedies with modern food technology to create a functional confectionery product. By developing an herbal vitamin chocolate, this research paves the way for innovative, health-focused alternatives that merge wellness and indulgence, making nutrient-rich foods more accessible and enjoyable.

Keywords: Moringa oleifera, Beet root, Dark Chocolate, White Chocolate, Vitamin A,B,C,E,K, Antioxidants

### 1. Introduction

Chocolate is an incredibly sophisticated and adaptable delicacy that can be mixed to produce unique tastes and textures. Chocolate is resistant to microbial growth and the hydrolysis of active ingredients that are water-sensitive because it is anhydrous. In many ways, using chocolate as a delivery system for active compounds makes sense. Chocolate is an adaptable food that can be combined to create completely different taste and texture sensations. Herbal formulations consist of one or more herbal preparations combined with an active ingredient, herbal preparation or herbal substance alone. Because of the health benefits of cocoa, chocolate-related products have been used as medicine for centuries in many cultures. Compared to milk or white chocolate, which do not offer the same health benefits, dark chocolate has a significantly higher concentration of antioxidants. Consumer demand for healthier foods with improved taste and convenience has urged the food industry to develop functional foods added with bioactive ingredients that can supplement basic nutrition (food supplement) or exert a pharmacological effect (nutraceuticals). The physicochemical properties and sensory acceptability of the functional chocolates presented are also highlighted.

#### 1.1 Characterization of Chocolate Eating Behavior:

- The dynamic sensory experience that occurs when consuming chocolate is very important to the consumer.
- However, to date very little has been published in the literature concerning how individuals eat chocolate and what variation in eating patterns may occur. Characterisation of chocolate eating behaviour is important as it will help understand its influence on consumer perception of its texture and flavour.
- Previous work in systems such as chewy confectionery products has also indicated that different chewing and swallowing patterns may influence sensory perception.
- Different eating patterns may therefore influence the sensory experiences associated with chocolate consumption and warrant further investigation.
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- 'Slow' eating has also been shown to decrease food intake and result in increased satiety.

- Eating behaviour is complex. According to Brown, chewing behaviour is the result of various physiological, anatomical and psychological factors, such as coordination of jaw movement, size and strength of masticatory muscles and the learned and habitual patterns of chewing. Changes to the physical properties of a food will also alter chewing behaviour, processing of food in the mouth, and the occurrence of swallowing events.
- However, although studies on the instrumental analysis of food's physical properties are widespread, literature investigating eating behaviour in response to these properties is limited.
- Techniques to measure physiological parameters during eating are available, but have not yet been applied to chocolate. Surface electromyography (sEMG) can be used to evaluate the activity of the masticatory muscles while chewing. It is nonintrusive and does not interfere with the eating process.

### 1.2 Herbal Chocolate:-

- Herbal chocolate is a type of chocolate that incorporates herbs and natural ingredients, offering potential health benefits and a unique flavour profile, often formulated as a “functional food.”
- The chocolate is most loving food of children whereas medicine is hating substance. So, the Objective of this study is to fabricate and design chocolate.
- Chocolate is a adaptable food that can be combined to create completely different taste and texture sensation. It is best drug delivery system specifically for children and youngsters.
- There are five basic human taste qualities. i.e. Sweet, Sour, bitter, salty, Savoury.
- Sweet taste is one of the most pleasurable tastes. The goal of the sweet taste is to detect the highly calorific saccharides for injection.
- Herbal formulation means a dosage form consisting of one or more herb or proceed herbs in specified quantities to provide specific nutritional, cosmetic benefits meant for use to diagnose, treat, mitigate.
- In many ways, chocolate is an excellent vehicle for delivering active chemicals. The aim of the present study to prepare study to prepare herbal chocolate for antioxidant, anti-cancer and anti-aging.
- Chocolate is an incredibly sophisticated and adaptable delicacy that can be mixed to produce unique tastes and textures. Chocolate is resistant to microbial growth and the hydrolysis of active ingredients that are water-sensitive because it is anhydrous. In many ways, using chocolate as a delivery system for active compounds makes sense.
- Chocolate is adaptable food that can be combined to create completely different taste and texture Sensations.
- To make medicated chocolate, you take a chocolate base and combine the drug with it.
- The process by which the drug is released from the chocolate after being integrated into it is referred to as the chocolate drug delivery system. This is the most effective way to give drugs to children.
- In herbal products the ingredients used like Moringa, Beet root, Tulsi, Neem, Turmeric, Thyme, Cinnamon, Cardamom and etc few ingredients are used which help to increase Multivitamins, Calcium, Enzymes, Vitamins and Antioxidants.

### Excipient Profile

→ List of excipients:

Sr.No	Ingredients	Roll of Ingredients
1	Moringa Powder	Multivitamin
2	Beetroot Powder	Antioxidant
3	Thyme Powder	Antioxidant
4	Almond Powder	Rich of vitamins and minerals
5	Tulsi Powder	Improve immunity
6	Cardamom powder	Improve blood circulation
7	Jaggary powder	Sweetening agent
8	Stevia	Sweetening agent

9	Dack chocolate	Base
10	White chocolate	Base

### 1.3 Moringa Powder:-

**Botanical name:** Moringa oleifera

**Common name:** Drumstick tree, Ben tree, Subhanjana, Saguna, Sanjana, Shevga

**Chemical constituents:**

- Moringa is rich in nutrition owing to the presence of a variety of essential phytochemicals present in its leaves, pods and seeds.
- Moringa is said to provide 7 times more vitamin C than oranges, 10 times more vitamin A than carrots, 17 times more calcium than milk, 9 times more protein than yoghurt, 15 times more potassium than bananas and 25 times more iron than spinach.
- Moringa is rich in phytosterols like stigmasterol, sitosterol and kampesterol which are precursors for hormones. These compounds increase the estrogen production, which in turn stimulates the proliferation of the mammary gland ducts to produce milk. It is used to treat malnutrition in children younger than 3 years.
- The leaves of M. Oleifera are rich in minerals like calcium, potassium, zinc, magnesium, iron and copper.
- Vitamins like beta-carotene of vitamin A, vitamin B such as folic acid, pyridoxine and nicotinic acid, vitamin C, D and E also present in M. Oleifera.

### 1.4 Beetroot Powder :-

**Synonyms:** Chukandar, Sugar beets, Mangel, Spinach beet

**Biological source:** It consists of fresh root of Beta vulgaris.

**Chemical Constituents:**

- **Betalains:** Beetroot owes its vibrant red color to a group of antioxidants called betalains. These compounds, including betanin and vulgaxanthin, have been shown to have potent antioxidant and anti-inflammatory effects.
- **Vitamin C:** Beetroot is a good source of vitamin C, which is a powerful antioxidant that helps neutralize free radicals and protect cells from damage. Vitamin C also plays a crucial role in collagen synthesis and supports immune function.
- **Manganese:** Beetroot contains manganese, a mineral that acts as a cofactor for several antioxidant enzymes, such as superoxide dismutase, which helps protect cells from oxidative damage.
- **Vitamin A:** While not as abundant in beetroot as in some other vegetables, it does contain a small amount of vitamin A, which has antioxidant properties and helps protect cells from damage caused by free radicals.
- **Flavonoids:** Beetroot contains various flavonoids, including quercetin, kaempferol, and rutin, which are potent antioxidants. Flavonoids have been associated with numerous health benefits, including reduced inflammation and protection against chronic diseases.

### 1.5 Thyme Powder: -

**Synonyms:** Indian Pennywort, Mangosteen

**Biological Source:** Thyme powder is derived from the dried leaves and flowering tops of the Thymus vulgaris plant, belonging to the Lemnaceae (mint) family

**Common Names:** Thyme, Common Thyme, Garden Thyme, Thyme, Tomillo, Thymine

**Chemical Constituents: -**

- The drug contains triterpenoid saponin glycosides, Indocen-telloside, brahmoside, brahminoside, Asiatic sides, thankuni-side and isothankuniside.
- The corresponding triterpene acids obtained on hydrolysis of the glycosides are indocentoic, brahmie, asiatic, thankunic and isothankunic acids.
- These acids, except the last two, are also present in free form in the plant from isobrahmic and betulic acid.

### 1.6 Almond Powder (Dry Fruit):-

**Synonyms:** Almond kernal, Thumbscrew, Hazelnut.

**Chemical Constituents:** Almonds contain a variety of chemical constituents including fatty acids (oleic and linoleic), vitamins (like vitamin E), minerals (like magnesium and copper), fiber, and phytosterols.

#### 1.6.1 Macronutrients:

- **Fat:** Almonds are rich in healthy unsaturated fats, primarily monounsaturated oleic acid and polyunsaturated linoleic acid.
- **Protein:** They are a good source of plant-based protein.
- **Carbohydrates:** Almonds contain carbohydrates, including dietary fiber.
- **Fiber:** Almonds are a good source of both soluble and insoluble dietary fiber.

#### 1.6.2 Micronutrients:

- **Vitamins:** Almonds are a source of Vitamin E, riboflavin, and other B vitamins like niacin, thiamine, and folate.
- **Minerals:** They contain essential minerals like magnesium, copper, manganese, calcium, and phosphorus.
- **Phytosterols:** Almonds contain phytosterols, such as beta-sitosterol, stigmasterol, campesterol, sitosterol, and campesterol.

### 1.7 Tulsi Powder:-

**Synonym Name:** Ocimum sanctum, Ocimum tomentosum

**Chemical Constituents:** Tulsi (Ocimum sanctum) contains various chemical constituents, including volatile oils like eugenol, carvacrol, and linalool, as well as compounds like ursolic acid, Rosmarinus acid, and flavonoids, contributing to its medicinal properties.

- **Eugenol:** A major component of Tulsi's essential oil, contributing to its aroma and potential medicinal effects.
- **Carvacrol:** Another important component of the essential oil, known for its antimicrobial properties.
- **Linalool:** A fragrant compound found in the essential oil, known for its calming and relaxing properties.
- **Ursolic Acid:** A triterpene compound with potential anti-inflammatory and antioxidant properties.
- **Rosmarinus Acid:** A phenolic acid with antioxidant and anti-inflammatory properties.
- **Flavonoids:** A group of plant pigments with antioxidant and anti-inflammatory properties, including apigenin, luteolin and orientin.

### 1.8 Cardamom Powder:

**Synonyms:** Cardamom fruit, Cardamon seed, Elachi

#### Chemical Compositions of Cardamom:

- Dried fruit of cardamom contains steam volatile oil, fixed (fatty) oil, pigments, proteins, cellulose, pentosans, sugars, starch, silica, calcium oxalate and minerals.
- The major constituent of the seed is starch (up to 50 per cent) while in the fruit husk it is crude fibre (up to 31 Per cent).
- Volatile oil is the most functionally important constituent of cardamom. The volatile oil content of seeds varies from 6.5 to 10.5% for the two types of cardamom (Malabar and Mysore) grown in India.
- In immature capsules, obtained in small quantities in all harvests (and more particularly in the last harvest), the volatile oil content is low, on the order of 4 to 5%.
- Cardamom contains 2.8–6.2% volatile oil, 10% protein, 1–10% fixed oil and up to 50% starch.
- The aroma and flavour of cardamom are obtained from the essential oils which is composed of mainly  $\alpha$ -terpinyl Acetate (20–55%) and 1,8-cineole (20–60%) which are responsible for specific Flavors to the cardamom.

### 1.9 Jaggery Powder:

**Synonym:** Brown Sugar, Palm Sugar.

- Jaggery is a common product in Asia and Africa. It is made from the juices of palm tree or sugarcane and is growing in popularity as a replacement for white sugar. It is a staple in India, where people call it gur.
- Jaggery contains some vitamins and minerals, making it comparatively healthier than white sugar. However, it is still a type of sugar, and consuming too much of it can have negative impact on a person's health.

**Composition of Jaggery:**

Sr.No	Contents	Amount present in jaggery
1	Sucrose	65–85 gm
2	Fructose and glucose	10–15 gm
3	Protein	280 mg
4	Potassium	1.5 gm
5	Magnesium	70-90 mg
6	Calcium	40-100 mg
7	Manganese	0.2-0.5 mg
8	Phosphorus	20-90 mg

### 1.10 Stevia:

**Synonym:** Sugar leaf

**Source:** Stevia rebaudiana

- Stevia, a natural sweetener derived from Stevia rebaudiana, has gained attention in pharmaceuticals due to its medicinal properties. It contains steviol glycosides, which contribute to its therapeutic effects.
- Stevia is 200 to 300 times sweeter than sucrose.
- Stevia is widely used in pharmaceutical formulations, including diabetic-friendly medications, herbal supplements, and functional foods. Its non-toxic and non-carcinogenic nature makes it a promising ingredient in health-related products.

**Pharmaceutical applications of stevia include:**

- **Anti-hyperglycaemic properties:** Stevia is used as a sugar substitute for diabetic patients, helping regulate blood glucose levels.
- **Antihypertensive effects:** Studies suggest that stevia may help lower blood pressure, making it beneficial for hypertensive individuals.
- **Antimicrobial and antifungal activity:** Stevia exhibits antimicrobial properties, which can be useful in pharmaceutical formulations.
- **Antioxidant and anti-inflammatory benefits:** It has been studied for its potential to reduce oxidative stress and inflammation.
- **Cancer-fighting potential:** Some research indicates that stevia may have anticancer effects, though further studies are needed.

### 1.11 Dark Chocolate:-

- Dark chocolate is a form of chocolate made of cocoa solids, cocoa butter and sugar. Dark chocolate has a higher cocoa percentage than white chocolate, milk chocolate, and semisweet chocolate. Dark chocolate is valued for claimed though unsupported - health benefits, and for being a sophisticated choice of chocolate. Similarly to milk and white chocolate, dark chocolate is used to make chocolate bars and as a coating for confectionery.
- Dark chocolate has a more bitter and intense flavor than other types of chocolate, and compared to other types of chocolate is reliant on the quality of the cocoa beans and cocoa butter used as ingredients. Making dark chocolate involves a process of mixing, refining, conching, and standardizing. Government and industry standards of what products may be labelled "dark chocolate" vary by country and market.
- Types Of Chocolate

➤ Dark Chocolate

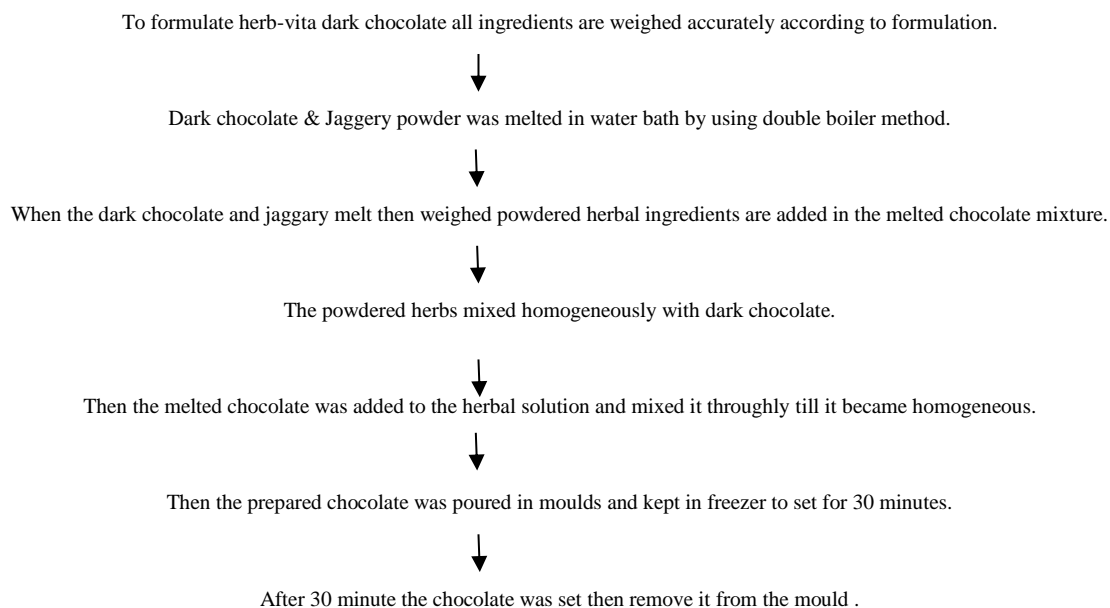
- White Chocolate
- Unsweetened (Bittersweet Chocolate)
- Milk Chocolate
- Cacao Powder
- Ground Chocolate

### 1.12 White Chocolate:-

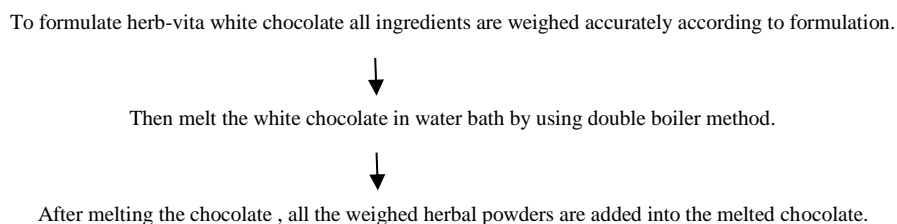
- White chocolate is a type of chocolate that is distinct from traditional dark and milk chocolates because it does not contain cocoa solids, the main component that gives chocolate its characteristic brown color and rich flavor. Instead, white chocolate is made from cocoa butter, which is the fat extracted from cocoa beans.
- White chocolate is typically high in sugar and fat, especially saturated fats, because of the cocoa butter. It also contains a moderate amount of milk solids, providing some calcium and protein, but its nutritional value is generally less than that of dark chocolate, which contains antioxidants from cocoa solids.
- **Characteristics:**
  - **Colour:** White chocolate has a pale ivory or off-white colors due to the absence of cocoa solids.
  - **Taste:** It has a sweet and creamy flavor profile, but without the bitterness or intensity of traditional chocolate, as it lacks cocoa solids.
  - **Texture:** White chocolate is smooth and melts easily due to the presence of cocoa butter.

## 2. Formulation and Development:-

### 2.1 Method for Formulation of Dark Chocolate:



### 2.2 Method for Formulation of White Chocolate:



↓  
Mix them properly till it becomes homogeneous into chocolate.

↓  
Then prepared chocolate was poured in moulds and kept in freezer to set for 30 min.

↓  
After 30 minute chocolate was set and keep them out from the mould.

❖ **Composition of Herb-vita Dark Chocolate Formulation:-**

Sr. No	INGREDIENTS	F1(30gm)	F2(30gm)	F3(30gm)	F4(30gm)	F5(30gm)
1	Moringa powder	0.5	1	1.2	1	0.8
2	Beetroot powder	2	1.5	1.3	1.2	1
3	Almond powder	1.5	1.5	2	2	2.5
4	Tulsi powder	0.5	0.5	0.5	0.5	0.5
5	Thyme powder	0.5	0.5	-	-	-
6	Cardamom powder	0.005	0.005	0.005	0.005	0.005
7	Jaggary powder	5	7	-	-	-
8	Stevia	-	-	0.005	0.005	0.005
9	Dark chocolate	20	18	25	25	25

❖ **Composition of Herb-vita White Chocolate Formulation:-**

Sr.No	INGREDIENTS	F1(30gm)	F2(30gm)
1	Moringa powder	1	0.8
2	Beetroot powder	1.2	1
3	Almond powder	2	2.5
4	Tulsi powder	0.5	0.5
5	Thyme powder	0.5	0.5
6	Cardamom powder	0.005	0.005
7	White Chocolate	25	25



Figure 3.3.1 Formulation – 1



Figure 3.3.2 Formulation – 2



Figure 3.3.3 Formulation - 3



Figure 3.3.5 Formulation - 5



Figure 3.3.4 Formulation - 4

### 3. Evaluation:

#### 3.1 Organoleptic Characterization of chocolate:

- 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.
- Also contains general appearance, colour and odour test.

#### 3.2 Weight Variation Test:

- This test is used to determine weight variation of chocolate to check the weight uniformity of each chocolate.
- **Procedure:**

First randomly select 5 chocolates from prepared batch.



Weigh them separately and collectively.



The weight of all the Chocolate was used to calculate the average weight



The average weight was contrasted with the individual weights.



The weight variation's percentage difference must stay within the Allowed bounds.



The following formula was used to determine the percent deviation.

$$\% \text{Deviation} = \frac{\text{Individual weight of chocolates}}{\text{Average weight of chocolate}} \times 100$$

#### 3.3 pH Test:

- The pH test in chocolate is used to measure its acidity or alkalinity, which can significantly impact its flavor, texture, and shelf life
- **Procedure for pH measurement:-** 3gm of prepared chocolate was dissolved in 100ml of phosphate buffer solution.



- Now calibrate the pH meter electrode using buffer solution and put them in to prepared chocolate solution and measured the pH of chocolate.

### 3.4 Melting point:

- Determining the melting point of chocolate requires precision, as chocolate doesn't have a sharp melting point but rather a melting range due to its complex composition.
- **Procedure:** -In this prepared chocolate was melted by double boiler method using water bath and measures the temperature using thermometer at which chocolate melt.
- Also check the melting point of chocolate at room temperature or normal temperature.

### 3.5 Stability Test:

- To check the stability of the chocolate is evaluated by studying it with appropriate storage conditions of nearly 2-8°C at time of preparation and chocolate was kept in closed container for one month interval, Test sample of chocolate was observed for physical appearance and drug degradation.

## 4. Results:

### 4.1 Organoleptic Characterization of Dark Chocolate:

Sr.No	Characterization	(F1)	(F2)	(F3)	(F4)	(F5)
1	Colour	Brown	Brown	Brown	Brown	Brown
2	Odour	Chocolaty	Chocolaty	Chocolaty	Chocolaty	Chocolaty
3	Taste	Bitter	Slightly bitter	Sweet and slightly bitter	Sweet and slightly bitter	Sweet and chocolaty
4	Mouth feel	Rough And Unpleasant	Slightly Rough and pleasant	Smooth and pleasant	Smooth and pleasant	Smooth and pleasant
5	Appearance	Non-Glossy	Non-Glossy	Slight Glossy	Glossy	Glossy

### 4.2 Organoleptic Characterization of White Chocolate:

Sr.No	Characterization	(F1)	(F2)
1	Colour	Light green	Light green
2	Odour	Pleasant	Pleasant
3	Taste	Sweet	Sweet
4	Mouth feel	Rough and Un-pleasant	Smooth and pleasant
5	Appearance	Non-Glossy	Glossy

### 4.3 Weight Variation Test:

Sr.No	Sample	Result (gms)
1	Dark chocolate(F1)	2.80
2	Dark chocolate(F2)	2.89

3	Dark chocolate(F3)	2.93
4	Dark chocolate(F4)	2.96
5	Dark chocolate(F5)	2.98
6	White Chocolate(F1)	2.85
7	White Chocolate(F2)	2.92

#### 4.4 pH Test:

Sr.No	Sample	pH of sample
1	Dark chocolate(F1)	6.63
2	Dark chocolate(F2)	6.82
3	Dark chocolate(F3)	6.58
4	Dark chocolate(F4)	6.75
5	Dark chocolate(F5)	6.69
6	White chocolate(F1)	6.65
7	White chocolate(F2)	6.68

#### 4.5 Melting Point:

- The melting point for dark chocolate generally ranges between 40°C to 45°C.
- The melting point for white chocolate generally ranges between 30°C to 35°C

#### 4.6 Stability Test:

- Both the chocolates are found to be stable at 2-8° C after 1 month

## 5. Conclusion

- The development of Herb-Vita Chocolate successfully incorporated functional herbal ingredients into a chocolate base, creating a product that offers both indulgence and potential health benefits. The final formulation F4 & F5 balanced taste, texture, and the herbal properties, ensuring that the herbal elements did not overpower the natural flavours of the chocolate.
- Herb-Vita Chocolate offers a unique niche in the growing health-conscious snacking market. The product's differentiation lies in its combination of luxury chocolate with functional herbs that appeal to health-conscious consumers, wellness enthusiasts, and those seeking stress-relief or immune-boosting snacks.
- The development and evaluation suggest that Herb-Vita Chocolate is ready for market testing, but additional efforts in educating consumers on the product's health benefits could enhance its appeal. Given current health trends, the product has the potential to be a strong player in the premium and functional snack markets.

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