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Formulation and Evaluation of Multivitamin and Antioxidant Herbal Chocolate

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Abstract- The chocolate is most loving food of children where as the medicine is the hating substance. So, objective of this study was to formulate the chocolate that contain drug i.e., medicated chocolate to prevent the disease. In children cough, viral infection is most common diseases. Dark chocolate gets popularity for several decades due to its enormous health benefits. Dark chocolate is considered a functional food due to its anti-diabetic, anti-inflammatory, and anti-microbial properties. It also has a well-established role in weight management and the alteration of a lipid profile to a healthy direction. Multivitamins are used to provide vitamins that are not taken in through the diet.Multivitamins are also used to treat vitamin deficiencies (lack of vitamins) caused by illness, pregnancy, poor nutrition, digestive disorders, and many other conditions. Antioxidant-the word itself is magic. Using the antioxidant concept as a spearhead in proposed mechanisms for staving off so-called "free-radical" reactions, the rush is on to mine claims for the latest and most effective combination of free-radical scavenging compounds. We must acknowledge that such "radicals" have definitively been shown to damage all biochemical components such as DNA/RNA, carbohydrates, unsaturated lipids, proteins, and micronutrientssuch as carotenoids (alpha and beta carotene, lycopene), vitamins A, B6, B12, and folate. Defense strategies against such aggressive radical species include enzymes, antioxidants that occur naturally in the body (glutathione, uric acid, ubiquinol-10, and others) and radicalscavenging nutrients, such as vitamins A, C, and E, and carotenoids.

Keywords— Multivitamins, Antioxidant, Moringa, Thyme.

I. INTRODUCTION

The Food and Nutrition Board (FNB) at the National Academies of Sciences, Engineering, and Medicine establishes RDAs and AIs. RDAs are the average daily level of intake of essential nutrients sufficient to meet the requirements of nearly all (97–98%) healthy individuals. These values vary by age, sex, and nutrient. The FNB establishes AIs for nutrients when evidence is insufficient to develop an RDA; intakes at this level are assumed to ensure nutritional adequacy
The U.S. Food and Drug Administration (FDA) develops DVs to help consumers compare the nutrient contents of foods and dietary supplements within the context of a total diet.

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). Chocolate could be used as an ideal carrier to deliver bioactive ingredients, mainly due to its high acceptability by consumers. The physicochemical properties and sensory acceptability of the functional chocolates presented are also highlighted. Finally, future perspectives, such as the use of nanotechnology to improve the bioaccessibility and bioavailability of active ingredients, as well as the need for clinical trials to validate the pharmacological effect of functional chocolates.

Using the term “antioxidant” to refer to substances is misleading. It is really a chemical property, namely, the ability to act as an electron donor. Some substances that act as antioxidants in one situation may be pro-oxidants—electron grabbers—in a different situation. Another big misconception is that antioxidants are interchangeable. They aren’t. Each one has unique chemical behaviors and biological properties. They almost certainly evolved as parts of elaborate networks, with each different substance (or family of substances) playing slightly different roles. This means that no single substance can do the work of the whole crowd . Randomized placebo-controlled trials, which can provide the strongest evidence, offer little support that taking vitamin C, vitamin E, beta-carotene, or other single antioxidants provides substantial protection against heart disease, cancer, or other chronic conditions. The results of the largest trials have been mostly negative.

Vitamin history really took off during the rest of the 1920s and into the '30s, as further nutrients were proved and further multivitamin- type products came available. "resoluteness," "vigor," and "vim" were promoted benefits. Vitamin constituents were being uprooted from food, but in the late 1930s, styles were developed to synthesize them in a lab, cutting costs and setting the stage for wider use. The result was the first set of government- patronized Recommended Dietary Allowances (RDAs) for six vitamins and two minerals. 1941 Vitamins A, B1, B2, B3, C, and D, calcium, and iron.• 1968 Vitamins E, B6, and B12, and magnesium join the list, and more are added in after times.• moment Vitamins A, B1(thiamin), B2(riboflavin), B3(niacin), B5(pantothenic acid), B6(pyridoxine,) B7(biotin), B9(folic acid), B12(cobalamin), C, D, E, K, choline, calcium, chromium, bobby , iodine, iron, magnesium, manganese, molybdenum, phosphorus, selenium, zinc, potassium, and chloride.A multivitamin is a medication intended to serve as a salutary supplement with vitamins, salutary minerals, and other nutritive rudiments. similar medications are available in the form of tablets, capsules, pastilles, maquillages, liquids, or injectable phrasings.

Antioxidants

A substance that protects cells from the damage caused by free radicals (unstable molecules made by the process of oxidation during normal metabolism). Free radicals may play a part in cancer, heart disease, stroke, and other diseases of aging. Antioxidants include beta-carotene, lycopene, vitamins A, C, and E, and other natural and manufactured substances.

Why antioxidants are necessary ?

Oxygen is absolutely essential for the life of aerobic organism but it may become toxic if Supplied at higher concentrations. Dioxygen in its ground state is relatively unreactive; its partial Reduction gives rise to active oxygen species (AOS) such as singlet oxygen, super oxide radical Anion, hydrogen peroxide etc. This is partly due to the oxidative stress that is basically the Adverse effect of oxidant on physiological function. The generation of reactive oxygen species (ROS) and other free radicals (R) during metabolism is a necessary and normal process that ideally is compensated for by an elaborate endogenous antioxidant system. However, due to many environmental, lifestyle, and pathological situations, excess radicals can accumulate, resulting in oxidative stress.

Free oxygen radicals plays cardinal role in The etiology of several diseases like arthritis, cancer, atherosclerosis etc. The oxidative damage to DNA may play vital role in aging and the presence of intracellular oxygen also can be Responsible to initiate a chain of inadvertent reaction at the cellular level and these reaction cause Damage to critical cell biomolecules. These radicals are highly toxic and thus generate oxidative Stress in plants. Plants and other organism have in built wide range of mechanism to combat with These Free Radical problems. Free radicals are an atom or molecule that bears an unpaired Electron and is extremely reactive, capable of engaging in rapid change reaction that destabilize other molecules and generate many more free radicals. In plants and animals these free radicals Are deactivated by antioxidants. These antioxidants act as an inhibitor of the process of Oxidation, even at relatively small concentration and thus have diverse physiological role in the body. Antioxidant constituents of plat materials act as radical scavengers, and convert the radicals to less reactive species

Plants have developed an array of defense strategies (antioxidant system) to cope up with oxidative stress. The antioxidative system includes both enzymatic and non-enzymatic systems. The non enzymatic system includes ascorbic acid (vitamin C); ά-tocopherol, cartenes etc. and enzymic system include superoxide dismutase (SOD), catalase (CAT), peroxidase (POX), ascorbate peroxidase (APX), glutathione reductase (GR) and polyphenol oxidase (PPO) etc. The function of this antioxidant system is to scavenge the toxic radicals produced during oxidative stress and thus help the plants to survive through such conditions.

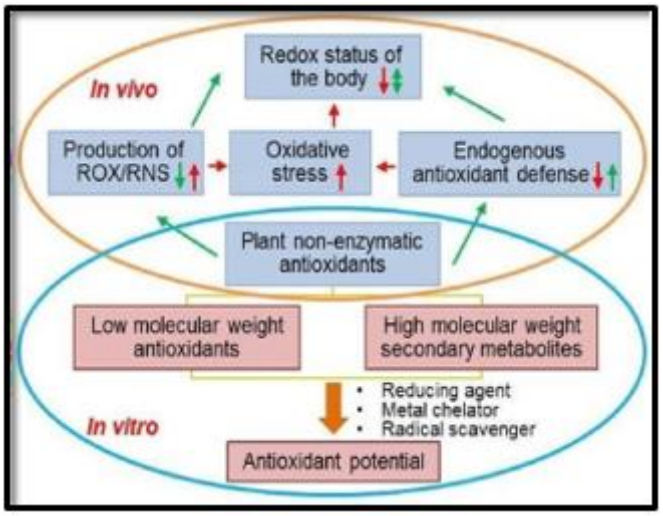

Fig no 1: Antioxidant potential

Spices and herbs in food as medicine is a current hot trend that is capturing everyone's Imagination with images of a new magic bullet or fountain of youth. The intake of antioxidant Compounds present in food is an important health-protecting factor. Natural antioxidants present In foods and other biological materials have attracted considerable interest

because of their Presumed safety and potential nutritional and therapeutic effects. Because extensive and Expensive testing of food additives is required to meet safety standards, synthetic antioxidants Have generally been eliminated from many food applications. The increasing interest in the Search for natural replacements for synthetic antioxidants has led to the antioxidant evaluation of A number of plant sources.

Why do all plants have antioxidant potential?
Chloroplasts and mitochondria are the two main powerhouses and sites of reactive oxygen species (ROS) generation within plant cells. These materials are also involved in maintenance of a fine balance between energy linked functions and control of ROS production.

Peroxisomes, single membrane-bound subcellular organelles, are a third important site of production of ROS such as hydrogen peroxide (H2O2), superoxide (O2● -) and nitric oxide (NO●) within plant cells. Peroxisomes contain basic enzymatic constituents such as catalase (CAT), as well as hydrogen peroxide (H2O2)-producing flavin oxidases . Within the plant cell, ROS generation occurs at photosystem I and II (PS I and PS II) of the chloroplasts, membrane and matrix of the peroxisome, and complex I, ubiquinone and complex III of the mitochondrial electron transport chain (ETC). Under normal physiological conditions, there is electron slippage from PS I and PS II of the chloroplasts, membrane of mitochondrial ETC and peroxisome.

These electrons later react with molecular oxygen to produce superoxide radical (O2-●). The superoxide radical is subsequently converted to hydroperoxyl radical (HO2●) and finally to H2O2. Similar to ROS, reactive nitrogen species (RNS) such as the nitric oxide radical (NO•) and peroxinitrite (ONOO-) are also formed in various compartments of the cell including the chloroplasts, mitochondria and peroxisomes . The third type of free radical, reactive sulfur species (RSS), are reportedly formed from thiols by reaction with ROS .These free radicals are constantly produced in the subcellular organelles of living cells. Most of the time, the production of free radicals is genetically planned, since they function as signaling molecules . However, overproduction of free radicals can also sometimes damage biomolecules such as DNA, proteins and lipids.

Plants have an innate ability to synthesize non-enzymatic antioxidants. However, under biotic and abiotic stress conditions, the production of reactive oxygen species (ROS) increases in the plants, resulting in induction of oxidative stress. In response to increased oxidative stress, plants augment the production and accumulation of several low molecular weight antioxidants (e.g., vitamin C, vitamin E, phenolic acids, etc.) and high molecular antioxidant secondary metabolites such as tannins, which confer antioxidants to most plants under in vitro studies by functioning as free radical scavengers, reducing agents, and metal chelators.

Natural antioxidants occur in all parts of plants. These antioxidants include carotenoids, vitamins, phenols, flavonoids, dietary glutathione, and endogenous metabolites . Plantderived antioxidants have been shown to function as singlet and triplet oxygenquenchers, free radical scavengers, peroxide decomposers, enzyme inhibitors, and synergists. The most current research on antioxidant action focuses on phenolic compounds such as flavonoids. Fruits and Vegetables contain different antioxidant compounds, such as vitamin C, vitamin E and Carotenoids, whose activities have been established in recent years. Flavonoids, tannins and other phenolic constituents Present in food of plant origin are also potential antioxidants.

These components include

- Nutrient-derived antioxidants like ascorbic acid (vitamin C), tocopherol and tocotrienols (vitamin E), carotenoids, and other low molecular weight compounds such as glutathione and Lipoic acid.
- Antioxidant enzymes, e.g., super oxide dismutase, glutathione peroxidase, and glutathione reductase, which catalyze free radical quenching reactions.
- Metal binding proteins, such as ferritin, lactoferrin, albumin, and ceruloplasmin that sequester free iron and copper ions that are capable of catalyzing oxidative reactions.
- Numerous other antioxidant phytonutrients present in a wide variety of plant foods.

Vitamins as a antioxidants
Vitamins are groups of complex organic compounds found in foodstuffs and essential for a healthy metabolism. Their deficiency can cause disorders, whereas resupply of these nutrients can alleviate deficiency symptoms .

Vitamins are different from other food nutrients due to their distinct organic nature, and their classification depends On their chemical nature and function . Growth, development, health, and reproduction require minute amounts Of vitamins . Some vitamins synthesised from other sources in the body deviate from the usual definition of Vitamins. For instance, Animals integrate ascorbic acid, tryptophan an essential amino acid produce niacin, while UV radiation from sunlight synthesises vitamin D. Generally, classification of Vitamins is into two groups:

- Water-soluble vitamins
- Fat-soluble vitamins

Example of water-soluble vitamins is:- Vitamins B complex and C and that of fat-soluble vitamins include: A, D, E, And K. Fat-soluble vitamins are associated with fats and are absorbed with dietary fats. The absorption of fat-soluble Vitamins is like the absorption of fats. Water-soluble vitamins are not associated with fats and are unaffected by Alterations in fat absorption

Vitamins functions and deficiencies

Table no: 1 Vit Functions

Vitamin	Vitamin Type	Functions	Deficiency
Vit A	Fat Soluble	Vision, Reproduction and Immunity	Night-blindness
Vit B	Water Soluble	Growth, development and cellular agility	Beri-beri
Vit C	Water Soluble	For bone health and stability	Scurvy
Vit D	Fat Soluble	maintaining strength and integrity of your bones	Rickets in children and osteomalacia in Adults
Vit E	Fat soluble	Antioxidant,	Cell Membrane damage especially red blood cells
Vit K	Fat Soluble	Formation of clotting factors in the blood	Haemorrhage

Moringa

Fig no 2: Moringa

Botanical name-Moringa oleifera
Common name
English- Drumstick tree, Horseradish tree, Ben tree Marathi-Shevga

The Moringa oleifera (drumstick tree) is a small fast growing ornamental tree which is native to India. The trees are said to have been originated from Agra and Oudh in North Western region of India to South of the Himalayan Mountains. They are cultivated in Asian, African, Middle Eastern and South American regions .It propagates relatively easily both by sexual and asexual means. It has a low soil nutrient and water demand making its production and management easy. They are drought resistant, and hence are able to withstand a wide range of soil and rainfall conditions and are therefore available throughout the year. People often call it a “huge quantity of phenolic compounds, principally flavonoids, phenolic acids and their glycosides.

Alkaloids, tannins, saponins, isothiocyanate, and glucosinolate were also found in Moringa oleifera leaf (Rocchetti et al., 2020). The main phenolic compounds discovered in Moringa oleifera leaves were kaempferol, myricetin, quercetin, chlorogenic acid, gallic acid, luteolin, vanillin, and rutin

Moringa oleifera plant is cultivated for its edible leaves, flowers, and nutritious pods which can be used as a medicine or ingredient in the food industry . Moringa oleifera leaf was the most utilized part of Moringa oleifera plants. It has been

reported that Moringa oleifera leaves were also rich in vitamin C, vitamin E, and beta-carotene.

There are thirteen species of Moringa. Few species which include Moringa stenopetala, Moringa drouhardii, Moringa hildebrandtii are known to have fat, protein and other nutrients profile comparable to Moringa oleifera to some extent . Out of these thirteen species Moringa oleifera is the most studied so far. As a source for protein and essential amino acids (EAA), M. oleifera leaves are superior to the leaves of M. hildebrandtii and M. drouhardii

Chemical Constituents

Moringa is rich in nutrition owing to the presence of a variety of essential phytochemicals present in its leaves, pods and seeds. In fact, 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 .

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.

Phytochemicals such as tannins, sterols, terpenoids, flavonoids, saponins, anthraquinones, alkaloids and reducing sugar present along with anti-cancerous agents like glucosinolates, isothiocyanates, glycoside compounds and glycerol-1-9-octadecanoate.

Moringa leaves also have a low calorific value and can be used in the diet of the obese. The pods are fibrous and are valuable to treat digestive problems and thwart colon cancer.

Immature pods contain around 46.78% fiber and around 20.66% protein content. Pods have 30% of amino acid content, the leaves have 44% and flowers have 31%. The immature pods and flowers showed similar amounts of palmitic, linolenic, linoleic and oleic acids.

Health benefits and medicinal use

Moringa oleifera is found to contain non-nutritive chemicals which they use as self defense mechanism also known as Phytochemicals. These phytochemicals include catechol tannins, gallic tannins, steroids, triterpenoids, flavonoids, saponins, antraquinones, alkaloids and reducing sugars.These chemicals have significant medicinal uses like as antibiotics, anti-inflammatory, for skin treatment, blood pressure regulation, anemia treatment and diabetes.Leaves of Moringa are known to have various biological activities, including antitumor, anticancer, prevention of cardiovascular diseases and antioxidant . It has been used traditionally to treat constipation.

Beetroot

Fig no 3: Beetroot

Synonyms

Chukandar, Sugar beets, Mangel, Spinach beet Biological source: It consists of fresh root of Beta vulgaris.

Geographical source

It is found in India, Europe and Western Asia

Biological Source

The biological source of beetroot is the plant known as Beta vulgaris, which belongs to the Amaranthaceae family. Beetroot is a root vegetable that is grown and harvested for its edible taproot. It has a deep reddish-purple color and is commonly used in cooking, juicing, and as a natural food coloring agent. Beetroot is known for its earthy flavor and nutritional benefits, including being a good source of dietary fiber, vitamins

Nutritional Composition

Table no 3: Nutritional Composition of Beetroot

Vitamin C	7.4%
Vitamin A	0.3% for males, and 0.39% for females
Folate	37%
Magnesium	7.83% for males, and 10.97% for females
Phosphorus	7.77%

Uses

Beetroot is known for its antioxidant properties. Antioxidants are compounds that help protect the body against oxidative stress and damage caused by free radicals.

Beetroot contains several antioxidants that contribute to its potential health benefits. Here are some of the antioxidants found in beetroot:

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.

Consuming beetroot or beetroot juice regularly may help increase your antioxidant intake and contribute to overall antioxidant defense in the body. Antioxidants play a crucial role in maintaining cellular health and may help reduce the risk of chronic diseases associated with oxidative stress. However, it's important to note that the overall health benefits of beetroot are influenced by various factors, including individual health status, overall diet, and lifestyle.

Blood pressure regulation: Beetroot contains high levels of nitrates, which are converted into nitric oxide in the body. Nitric oxide helps relax and dilate blood vessels, leading to improved blood flow and potentially lowering blood pressure. Drinking beetroot juice or incorporating beetroot into your diet may help manage hypertension.

Thyme

Fig no 4: Thyme

Synonyms

Indian Pennywort, Mangosteen.

Biological Source

Brahmi is the fresh or dried herb of Centellaasiatica (L.) (syn. Hydrocotylasiatica Linn.), belonging to family Scrophuariaceae Geographical

Source

The plant is found in swampy areas of India, commonly found as a weed in crop fields and other waste places throughout India up to an altitude of 600 m and also in Pakistan, Sri Lanka and Madagascar.

Chemical Constituents

The drug contains triterpenoid saponin glycosides, indocentelloside, brahmoside, brahminoside, asiaticosides, thankuniside and isothankuniside. The corresponding trirerpene acids obtained on hydrolysis of the glycosides are indocentoic, brahmic, asiatic, thankunic and isothankunic acids. These acids, except the last two, are also present in free form in the plant from isobrahmic and betulic acids.

Chemical Compositions of Brahmi

Table no 4: Chemical Constitutents of Thyme

Component	Amount(/100gm)
Protein	2.1gm
Fat	0.6gm
Cabohydrates	5.9gm
Crude fiber	1.05gm
Calcium	202.0gm
Phosphorus	16.0gm
Ascorbic acid	63.0
Nicotinic acid	0.3

Uses

Cognitive function and memory: Brahmi is known for its ability to enhance cognitive function, improve memory, and promote mental clarity. It is often used as a natural remedy to support learning, concentration, and focus. It may also help reduce age-related cognitive decline.

Stress and anxiety relief: Brahmi has adaptogenic properties, which means it helps the body adapt to stress and promotes relaxation. It may help reduce anxiety, calm the mind, and alleviate symptoms of stress and tension.

Neuroprotective effects: Brahmi is believed to have neuroprotective properties, meaning it helps protect brain cells from damage. It may support the growth and development of nerve cells, enhance neuronal communication, and improve overall brain health.

Antioxidant activity: Brahmi contains antioxidants that help neutralize harmful free radicals in the body, protecting cells from oxidative damage. This antioxidant activity may contribute to its neuroprotective effects and overall health benefits.

Fig no 5: Tulsi

5.1.4Tulsi

II. RELATED WORK

The landscape of Android malware detection has seen a paradigm shift toward machine learning and deep learning to achieve better scalability and accuracy. Because traditional signature-based systems fall short against novel variants, intelligent, learning-based models have become the standard.
A comprehensive survey in [1] details the transition to-ward deep learning in Android malware analysis, focusing on static features like permissions and opcodes. However, the authors note that high computational complexity and feature redundancy remain significant hurdles. Frameworks like DroidDetector [2] and Semantics-Aware DNNs [3] utilize static and behavioral patterns to improve detection rates, yet they often struggle with previously unseen families or demand immense computational power for feature engineering.

Other systems, such as DroidCat [4], rely on application-level profiling, while approaches in [5] use feature fusion coupled with attention mechanisms. Though effective, these methods introduce high model complexity. Machine learning tools like MLDroid [6] and HinDroid [7] process static fea-tures and complex application relationships, respectively, but face limitations against heavily obfuscated code and require vast datasets to model heterogeneous information networks accurately.

More recently, research has pivoted toward malware visual-ization. Studies [8] and [9] demonstrated that converting byte-code into grayscale images and utilizing CNNs eliminates the need for manual feature extraction. While highly automated, single-model approaches sometimes fail to capture nuanced contextual data. Ensemble deep learning models [10] address this by fusing multiple architectures, improving overall robust-ness, though optimizing these frameworks for computational efficiency remains an active area of research.

Synonyms
Sacred basil, Holy basil.

Biological Source
Tulsi consists of fresh and dried leaves of Ocimum sanctum, belonging to family Labiatae.

Tulsi Medicinal Uses &Benefits
Promotes Healthy Heart : Holy basil contains vitamin C and antioxidants such as eugenol, which protects the heart from the harmful effects of free radicals. Eugenol also proves useful in reducing cholesterol levels in the blood.

Anti-aging : Vitamin C and A, phytonutrients, in Holy Basil are great antioxidants and protect the skin from almost all the damages caused by free radicals.

Treats Kidney Stones : Tulsi acts a mild diuretic & detoxifying agent which helps in lowering the uric acid levels in the body. Acetic acid present in holy basil helps in the breakdown of the stones.

Relieves Headaches: Tulsi is a natural headache reliever which can also relieve migraine pain.

Antioxidant activity: Tulsi contains various antioxidants, such as eugenol, rosmarinic acid, and flavonoids. These compounds help neutralize harmful free radicals in the body and protect against oxidative stress.

Medicinal Properties of Tulsi
Antispasmodic, appetizer, carminative, galactagogue, stomachic. Basil is antispasmodic, appetizer, carminative, galacta gogue, and stomachic. It is used for stomach cramps, gastric catarrh, vomiting, intestinal catarrh, constipation, and enteritis. It had been sometimes used for whooping cough as an antispasmodic.

- Tulsi has antioxidant properties and reduces blood glucose levels. Thus it is useful for diabetics.
- Tulsi reduces total cholesterol levels. Thus it is useful for heart disease patients.
- Tulsi reduces blood pressure.
- Tulsi is also used to prepare herbal tea. It helps in building up stamina.
- It has been used for gastric disorders, cough, common colds, malaria, and headaches.
- It is used as mouth wash for reducing toothache
- Tulsi oil shows larvicidal activity against malarial larva.
- It has immuno-modulatory properties.

Cinnamon

Fig no 6: Cinnamon

Biological Name
Cinnamomum verum

Geographical Source
Cinnamomum verum trees are 10–15 metres (30–50 feet) tall. The leaves are ovateoblong in shape and 7–18 cm (3–7 inches) long. The flowers, which are arranged in panicles, have a greenish color and a distinct odour. The fruit is a purple 1cm drupe containing a single seed.

Medicinal use of cinnamon
In addition to being an antioxidant, anti-inflammatory, antidiabetic, antimicrobial, anticancer, lipid-lowering, and cardiovascular-disease-lowering compound, cinnamon has also been reported to have activities against neurological disorders, such as Parkinson's and Alzheimer's diseases. Ceylon cinnamon is full of antioxidants, which help your body handle free radicals and lowers your risk of health conditions like cancer, heart disease, and diabetes

Health Benefits of Cinnamon

- Contains powerful medicinal properties. ...
- Loaded with antioxidants. ...
- May have anti-inflammatory properties. ...
- Could protect against heart disease. ...
- Could improve sensitivity to insulin. ...
- Helps lower blood sugar levels. ...
- May have beneficial effects on neurodegenerative diseases.

Cinnamon Side Effects
Irritation and allergies. Cinnamon usually causes no side effects. But heavy use could irritate your mouth and lips, causing sores. Some people are allergic to it. It might cause redness and irritation if you put it on your skin.

Toxicity. Eating lots of cassia cinnamon could be toxic, especially if you have liver problems. Coumarin, an ingredient in some cinnamon products, can cause liver problems, but the amount you'd get is so small that it probably won't be a problem. Given the lack of evidence about its safety, children, pregnant women, and women who are breastfeeding should avoid cinnamon as a treatment.

Lower blood sugar. Cinnamon may affect your blood sugar, so if you have diabetes and take cinnamon supplements, you might need to adjust your treatment.

Cardamom

Fig no 7: Cardamom

Synonyms:
Cardamon fruit, Cardamon seed, Cardamomisemina, Malabar cardamums, Capalaga, Gujatatt ielachi, Ilachi, Ailum.

Biological Source:
Cardamon consists of the dried ripe seeds of Elettaria cardamomum Maton., belonging to family Zingiberaceae.

Geographical Source
It is cultivated in South India and Ceylon. Like Mysore, Kerala, etc.

Chemical Compositions of Cardamon
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.

Cardamom contains 2.8–6.2% volatile oil, 10% protein, 1–10% fixed oil and up to 50% starch. The aroma and flavor of cardamom are obtained from the essential oils which is composed of mainly α-terpinyl acetate (20– 55%) and 1,8-cineole (20–60%) which are responsible for specific flavor to the cardamom.

Health Benefits and Medicinal uses
Improves Digestive Health: According to an Indian study, cardamom can be used in cuisines not just for flavor, but also for enhancing digestion. The spice also stimulates metabolism, given its antioxidant and anti-inflammatory properties.

Improves Oral Health: Cardamom possesses antimicrobial properties that enhance oral health. Cardamom can protect against oral pathogens like Streptococci mutans. The pungent taste of cardamom even stimulates the salivary flow – and this can help prevent dental caries.

Improves Blood Circulation: Cardamom contains vitamin C, which is a powerful antioxidant. It improves blood circulation throughout the body.

Anti-inflammatory properties:- Inflammation occurs when the body is exposed to foreign substances. Acute inflammation is beneficial to the body but long-term inflammation can lead to the risk of chronic diseases. Antioxidants can protect cells from damage and stop inflammation. As cardamom has antioxidants abundantly, it can help in reducing inflammation.

Chocolate

Fig no 8 : Dark chocolate

Chocolate is a food made from roasted and ground cacao seed kernels that is available as a liquid, solid, or paste, either on its own or as a flavoring agent in other foods. Cacao has been consumed in some form since at least the Olmec civilization (19th-11th century BCE), and the majority of Mesoamerican

people including the Maya and Aztecs made chocolate beverages.

The seeds of the cacao tree have an intense bitter taste and must be fermented to develop the flavor. After fermentation, the seeds are dried, cleaned, and roasted. The shell is removed to produce cocoa nibs, which are then ground to cocoa mass, unadulterated chocolate in rough form. Once the cocoa mass is liquefied by heating, it is called chocolate liquor. The liquor may also be cooled and processed into its two components: cocoa solids and cocoa butter. Baking chocolate, also called bitter chocolate, contains cocoa solids and cocoa butter in varying proportions, without any added sugar.

Powdered baking cocoa, which contains more fiber than cocoa butter, can be processed with alkali to produce dutch cocoa. Much of the chocolate consumed today is in the form of sweet chocolate, a combination of cocoa solids, cocoa butter or added vegetable oils, and sugar. Milk chocolate is sweet chocolate that additionally contains milk powder or condensed milk

Nutrition

One hundred grams of milk chocolate supplies 540 calories. It is 59% carbohydrates (52% as sugar and 3% as dietary fiber), 30% fat and 8% protein (table). Approximately 65% of the fat in milk chocolate is saturated, mainly palmitic acid and stearic acid, while the predominant unsaturated fat is oleic acid (table).

100-grams of milk chocolate is an excellent source (over 19% of the Daily Value, DV) of riboflavin, vitamin B12 and the dietary minerals, manganese, phosphorus and zinc. Chocolate is a good source (10–19% DV) of calcium, magnesium and iron.

Benefits of Dark Chocolate

Source of Antioxidants

- Dark chocolate is a good source of several antioxidant compounds, such as flavonols and polyphenols. These compounds help neutralise free radicals and prevent oxidative stress in the body. Preventing oxidative stress lowers the chances of damage made by free radicals.
- The advantage of Dark Chocolate is that the body also works as an anti-inflammatory agent. Therefore, it reduces the risk of chronic inflammation and protects the cells and tissues from serious damage.
- Posses anti-inflammatory properties
- Reduces risk of chronic inflammation

Regulates Blood Pressure

The presence of flavanols in dark chocolate can stimulate nitric oxide production in the human body. Nitric oxide can make the blood vessels dilate or widen.

Moderate servings of dark chocolate are enough to increase blood vessel flexibility and ease stiffness in arteries. So it promotes better blood flow in the body and lowers blood pressure. The antihypertensive properties of dark chocolate are actually responsible for regulating blood pressure.

Fig no 9: Weighing of Ingredients

Jaggery

Fig no 10: Jaggery

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 a negative impact on a person's health.

Benefits of jaggery

- aid in digestion.
- detox the liver and blood.
- treat lung and bronchial infections
- relieve constipation.
- increase energy levels

II. METHOD

1. Preformulation Study
Preformulation Studies
Organoleptic Evaluation
The colour, odour, taste, and appearance of Moringa powder, Beetroot powder, Thyme powder, Tulsi powder, Cinnamon powder, Cardamom powder, Dark chocolate, and Jaggery were evaluated.

Identification of Ingredients
All herbal ingredients were identified based on their botanical source and standard literature references.

Compatibility Study
The compatibility of herbal powders with dark chocolate and jaggery was observed for any incompatibility, colour change, precipitation, or change in odour.

Particle Size Examination
All powdered ingredients were examined for uniform particle size to ensure homogeneous mixing in the formulation.

Moisture Content Observation
Herbal powders were stored under dry conditions because moisture may affect the stability and quality of the chocolate formulation.

pH Study
The pH of the prepared chocolate formulations was measured:

- F1 = 6.41
- F2 = 6.26
- F3 = 6.35

Selection of Excipients
Dark chocolate was selected as the carrier base, and jaggery was used as the sweetening agent.

Formulation Design
Three batches, namely F1, F2, and F3, were prepared by varying the concentration of herbal ingredients while keeping the excipients constant.

Formulation Study

- Accurately weigh all ingredients according to the selected formulation.
- Weigh 7 g of jaggery powder and add 10 mL of water to prepare a jaggery solution.
- Melt the jaggery solution using a double boiler water bath method until a uniform solution is obtained.
- Add the weighed quantities of Moringa powder, Beetroot powder, Thyme powder, Tulsi powder, Cinnamon powder, and Cardamom powder into the molten jaggery solution.
- Mix thoroughly to obtain a homogeneous herbal mixture.
- Separately weigh the required quantity of dark chocolate (20 g) and melt it using the double boiler method.
- Add the melted dark chocolate to the herbal-jaggery mixture and stir continuously until a smooth, uniform mass is formed.
- Pour the prepared chocolate mass into suitable moulds.
- Keep the moulds in a refrigerator/freezer and allow them to set overnight.
- Remove the chocolates from the moulds and store them in airtight containers for further evaluation.

Preparation Formula

Table no 5: Preparation Formula of multivitamin & Antioxidant Herbal Chocolate

Ingredients	Quantity of Ingredients (in gm)		
	F1 Batch	F 2 Batch	F3 Batch
Moringa Powder	0.5	1.5	0.8
Beetroot Powder	2	1	1
Thyme Powder	0.5	0.7	1
Tulsi Powder	0.05	0.05	0.05
Cinnamon Powder	0.002	0.002	0.002

Cardamon Powder	0.005	0.005	0.005
Dark Chocolate	20	20	20
Jaggery Powder	7	7	7

Three different batches of herbal chocolate formulation were prepared in order to optimize the concentration of herbal ingredients and obtain the best formulation with acceptable taste, texture, stability, and antioxidant activity.

Batch F1
Composition
Batch F1 contained minimum concentration of herbal ingredients with fixed quantity of dark chocolate base and jaggery.

Observation
- Smooth texture obtained
- Pleasant chocolate aroma
- Mild herbal taste
- Good appearance and gloss
- Lower herbal aftertaste
- Moderate antioxidant potential

III. RESULT AND DISCUSSION

The F1 batch showed excellent patient acceptability because of lower concentration of herbal powders. Dark chocolate effectively masked the herbal odor and bitterness. However, due to lower quantity of active herbal ingredients, antioxidant and multivitamin potential was comparatively less. This formulation was suitable in terms of taste and texture but showed reduced therapeutic value.

Batch F2
Composition
Batch F2 contained moderate concentration of herbal ingredients with balanced proportion of chocolate and herbal powders.

Observation
- Uniform texture
- Pleasant aroma with slight herbal flavor
- Good hardness and molding properties
- Better antioxidant activity
- Stable formulation without cracking or blooming

Result and Discussion
Batch F2 showed balanced organoleptic and functional properties. The concentration of herbal ingredients was sufficient to improve antioxidant activity while maintaining acceptable taste and texture. The chocolate formulation remained stable during storage and showed proper consistency. This batch demonstrated better nutritional and therapeutic properties than F1.

Batch F3
Composition
Batch F3 contained highest concentration of herbal ingredients for maximizing antioxidant and multivitamin activity.

Observation
- Dark brown appearance
- Strong herbal odor and taste
- Slightly rough texture
- Increased antioxidant activity
- Slight bitterness observed
- Reduced patient acceptability

Result and Discussion
The F3 formulation showed maximum antioxidant potential because of higher concentration of herbal powders such as moringa, beetroot, tulsi, thyme, cinnamon, and cardamom. However, increased herbal content affected taste, mouthfeel, and overall acceptability. Slight bitterness and strong herbal flavor were observed despite the presence of dark chocolate and jaggery.

Although F3 showed better therapeutic and antioxidant properties, patient compliance was comparatively lower due to strong herbal taste.

Comparative Evaluation of Batches

Evaluation Parameter	F1	F2	F3
Appearance	Excellent	Excellent	Good
Taste	Excellent	Good	Moderate
Texture	Smooth	Smooth	Slightly rough
Aroma	Pleasant	Pleasant	Strong herbal
Stability	Good	Excellent	Good

Evaluation Parameter	F1	F2	F3
Antioxidant Activity	Moderate	Good	Excellent
Patient Acceptability	Excellent	Excellent	Moderate

Optimized Batch Result

Among all formulations, Batch F2 was considered as the optimized formulation because it showed:

- Good antioxidant activity
- Acceptable taste and aroma
- Smooth texture
- Better stability
- Good patient acceptability
- Proper balance between therapeutic effect and palatability

Therefore, F2 batch was selected as the best formulation for multivitamin and antioxidant herbal chocolate preparation.

Evaluation Study

Sr. No.	Evaluation Test
1	Organoleptic Evaluation
2	pH Test
3	Hardness Test
4	Weight Variation Test
5	Blooming Test
6	Stability Study

Methods of Evaluation Test

Organoleptic Evaluation

The prepared chocolate formulation was visually examined for colour, odour, taste, texture and overall appearance by physical observation.

pH Test

A small quantity of chocolate formulation was dispersed in distilled water and the pH was measured using a calibrated digital pH meter.

Hardness Test

The hardness of chocolate was evaluated manually by applying slight pressure to determine firmness and resistance to breakage.

Weight Variation Test

Individual chocolates from each batch were weighed separately using a digital weighing balance and the average weight was calculated to determine uniformity.

IV. METHODOLOGY

Formulation of chocolate

- To formulate herbal multivitamin antioxidant chocolate all ingredients are weighed appropriately according to formula.
- 7 gm of Jaggery was weighed and 10 ml water was added in Jaggery powder.
- Jaggery powder solution was melted in water bath by using double boiler method.
- When the Jaggery solution was formed then weighed powdered herbal ingredients are added in the Jaggery solution
- The powdered herbs mixed homogeneously with Jaggery solution.
- Dark chocolate was weighed and melted in water bath by using double boiler method.
- Then melted chocolate was added to the herbal solution and mixed it thoroughly till it become homogeneous.
- Then the prepared chocolate containing Herbal drug extract was poured in moulds And kept in freeze to set overnight.
- Total 3 formulations were prepared by Varying the concentration of herbal drug Extract used, while the concentration of Excipients was kept constant.

V. RESULT AND DISCUSSION

1. Preformulation Study Result

The preformulation study was carried out to evaluate the physicochemical and medicinal properties of all herbal ingredients used in the formulation of multivitamin and antioxidant herbal chocolate. The selected ingredients such as Moringa powder, Beetroot powder, Thyme powder, Tulsi powder, Cinnamon powder, Cardamom powder, Dark chocolate, and Jaggery were studied for their antioxidant activity, nutritional value, compatibility, and therapeutic importance.

Moringa powder was found to be rich in vitamins A, B-complex, C, D, and E along with calcium, potassium, iron,

magnesium, and proteins, which make it an excellent multivitamin source. Beetroot powder showed strong antioxidant activity due to the presence of betalains, flavonoids, vitamin C, and phenolic compounds. Thyme and Tulsi exhibited antimicrobial, antioxidant, and immunity-enhancing properties. Cinnamon acted as a natural antioxidant and anti-inflammatory agent, while Cardamom improved blood circulation and digestion.

The compatibility study revealed that all herbal ingredients were compatible with the chocolate base and jaggery without producing any undesirable reaction, discoloration, or instability. The powders possessed suitable color, odor, and texture for incorporation into chocolate formulation. The preformulation study confirmed that the selected herbal ingredients were appropriate for preparing a stable, nutritious, and antioxidant-rich herbal chocolate formulation.

Formulation Study Result

The formulation study was carried out by accurately weighing all ingredients and incorporating them into molten dark chocolate followed by proper mixing, molding, and freezing.

Formula Preparation Calculation

Ingredient	Quantity
Dark Chocolate	50 gm
Moringa Powder	2 gm
Beetroot Powder	2 gm
Thyme Powder	1 gm
Tulsi Powder	1 gm
Cinnamon Powder	0.5 gm
Cardamom Powder	0.5 gm
Jaggery	5 gm

Total Weight Calculation

Total Weight=50+2+2+1+1+0.5+0.5+5

Total Weight=50+2+2+1+1+0.5+0.5+5 Total Weight=62 gm

Percentage Contribution Calculation

Example for Moringa Powder

Percentage=622×100 =3.22%= 3.22\%=3.22%

Ingredient Percentage

Ingredient	Percentage
Dark Chocolate	80.64%
Moringa Powder	3.22%
Beetroot Powder	3.22%
Thyme Powder	1.61%
Tulsi Powder	1.61%
Cinnamon Powder	0.80%
Cardamom Powder	0.80%
Jaggery	8.06%

The prepared chocolate showed uniform dispersion of herbal powders with smooth texture and acceptable consistency. No cracking, blooming, or separation was observed after molding and freezing. The chocolate exhibited good appearance, pleasant aroma, and acceptable taste.

Evaluation Study Result

The prepared herbal chocolate was evaluated for organoleptic properties, weight variation, pH, and stability studies.

Parameter	Observation
Color	Dark Brown
Odor	Pleasant Aromatic
Taste	Sweet and Herbal
++++++++++++++++++	Smooth
Appearance	Uniform and Glossy

The chocolate showed satisfactory organoleptic properties with good consumer acceptability.

Weight Variation Test

Five chocolates were weighed individually.

Sample	**Weight (gm)**
1	6.1

Sample	Weight (gm)
2	6.0
3	6.2
4	5.9
5	6.1

Average Weight Calculation

Average Weight=6.1+6.0+6.2+5.9+6.15 {Average Weight} = \frac{6.1 + 6.0 + 6.2 + 5.9 + 6.1}

Average Weight=56.1+6.0+6.2+5.9+6.1 =30.35= \frac{30.3}{5}=530.3 =6.06 gm

The prepared chocolates showed minimal weight variation indicating uniformity of formulation.

pH Determination

Sample	pH
Herbal Chocolate	6.8

The pH of the prepared chocolate was found to be near neutral, indicating good stability and suitability for oral consumption.

Stability Study

The formulation was stored at room temperature and evaluated for physical changes.

Parameter	Observation
Color Change	Absent
Odor Change	Absent
Texture Change	Absent
Fungal Growth	Absent

The stability study confirmed that the prepared herbal chocolate remained stable throughout the storage period without any significant physical or microbial changes.

Final Results of All Batches

The prepared herbal chocolate formulations (F1, F2, and F3) were evaluated for organoleptic properties, physical appearance, stability, texture, taste, and overall acceptability. The results obtained are summarized below.

Parameter	F1	F2	F3
Color	Dark Brown	Dark Brown	Dark Brown
Appearance	Excellent	Excellent	Good
Odor	Pleasant	Pleasant	Strong Herbal
Taste	Excellent	Good	Slightly Bitter
Texture	Smooth	Smooth	Slightly Rough
Hardness	Good	Excellent	Good
Stability	Good	Excellent	Good
Antioxidant Potential	Moderate	High	Very High
Patient Acceptability	Excellent	Excellent	Moderate
Overall Performance	Good	Best	Good

Final Result of Batch F1

Batch F1 containing the lowest concentration of herbal ingredients showed excellent taste, smooth texture, and pleasant aroma. The formulation was highly acceptable because the herbal flavor was effectively masked by dark chocolate and jaggery. However, due to the lower concentration of active herbal ingredients, the antioxidant and multivitamin potential was comparatively lower. Therefore, F1 was considered suitable from a palatability point of view but less effective therapeutically.

Result

F1 passed all evaluation parameters and showed good formulation characteristics.

Final Result of Batch F2

Batch F2 containing a moderate concentration of herbal ingredients demonstrated optimum balance between therapeutic efficacy and consumer acceptability. The formulation exhibited excellent appearance, smooth texture, pleasant aroma, acceptable taste, and good stability. The

antioxidant activity was significantly improved compared to F1 while maintaining satisfactory organoleptic properties.

Result
F2 passed all evaluation parameters and was selected as the optimized batch due to its superior overall performance.

Final Result of Batch F3
Batch F3 containing the highest concentration of herbal ingredients exhibited maximum antioxidant potential and nutritional value. However, increased herbal content produced a strong herbal flavor, slight bitterness, and reduced consumer acceptability. Although therapeutically superior, the formulation was less palatable compared to F1 and F2.

Result
F3 passed all evaluation parameters but showed lower patient acceptability because of strong herbal taste and aroma.

General appearance
The visual identity and overall elegance of a chocolate formulation are what determine its Overall appearance, which is important for consumer acceptability and trouble-free Manufacture.

Fig no 11: Herbal Chocolate

Dimensions
The dimension of the chocolate was evaluated while using Vernier's callipers .

Weight Variation
Six chocolate recipes were weighed 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 per cent deviation .

$$\%\text{Deviation} = \quad \text{Average weight}$$

Hardness test
To shatter a chocolate bar across its circumference, a certain amount of hardness is needed. The strength of chocolate can be determined by how hard it is. Using a Monsanto Hardness Tester, the hardness was determined. Kg/cm2 was used to express the values

pH of chocolate formulation
Procedure for pH measurement

- Rinse the electrode.
- Electrode is calibrated by using distilled water till the pH become 7
- Put the meter into measurement mode.
- The electrode is inserted into the chocolate sample.
- Readings are recorded

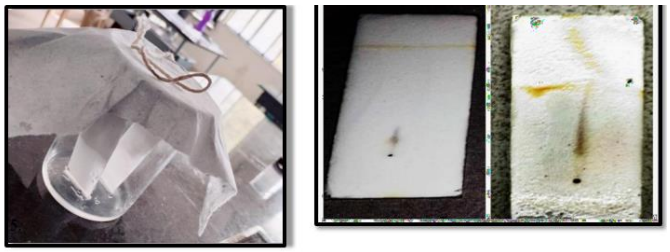

Fig no 12: pH Determination Drug content determination:-

Drug content of medicated chocolate was determined by Thin Layer Chromatography. Here, control was taken as Aqueous moringa extract and test as melted chocolate Sample. TLC plates were prepared by using silica G and Plates were activated for ½ Hr. Spotting was carried out On both plates i.e., control and test plate by using Capillary. Run both the plates in mobile phase i.e.,Chloroform :Methanol: Water having ratio 12:3:1 After Running of both plates air drying of plates was carried Out

Fig No 13: Thin layer Chromatography Test

Organoleptic properties
Dimensions
It was measured by Vernier's callipers
Avg. Width of 5 chocolate formulations: 1.85+1.90+1.84+1.85+1.86
5
The average width of 5 chocolate is observed to be = 1.86
Weight variation determination:-

Average Weight of 5 formulations: W1+W2+W3+W4+W5
5
Average weight calculated to be (for batch 3) = 5.9+5.8+5.6+5.7+5.9
5
Average weight calculated to be (for batch 3) = 5.78gm
Similarly weight variations for other 2 batches was also calculated

Table no 7: Weight Variation

Parameter	F1	F2	F3
Avarage weight	6.02gm	5.82gm	5.78gm

Hardness test:-
To shatter a chocolate bar across its circumference, a certain amount of hardness is needed. The strength of chocolate can be determined by how hard it is. Using a Monsanto Hardness Tester, the hardness was determined. Kg/cm2 was used to express the values.

Initial reading on hardness tester = 2.9 kg/cm
After breakage of chocolate = 8.2kg/cm
Therefore, hardness present in the chocolate formulation = 8.2 kg/cm-2.9kg/cm Hardness present in the chocolate formulation is = 5.3 kg/cm
Stability study:-

F3 batch was selected for stability study.

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

Stability of the chocolate is evaluated by studying it with appropriate storage conditions of nearly 2-8°C at time of preparation and after 15days of storage at given storage conditions

Drug content determination
Observation
- Distance travelled by solvent of control – 4cm.
- Distance travelled by solute of control – 0.9cm.
- Distance travelled by solvent of test – 4.3cm.
- Distance travelled by solute of test – 1cm.

Formula
RF value = Distance travelled by solute ÷ Distance Travelled by solvent Calculation:-
RF value = Distance travelled by solute of Control ÷ Distance travelled by solvent of control
= 0.9 ÷ 4
= 0.22
1) RF value = Distance travelled by solute of Test÷Distance travelled by solvent of test
= 1÷4.3
=0.23

By comparing RF value of both i.e., control and test Approximately nearby. So, we can determine drug Content.

VI. CONCLUSION

This research can be concluded that opting for an infused herbal chocolate offers greater health .benefits compared to chocolates crafted with artificial sweeteners and preservatives. Herbal Chocolate having antitussive activity was carried out.

By using prepared extract medicated chocolate prepared and evaluated for general appearance, dimension, hardness, blooming test, drug content determination and physical stability. We concluded that the chocolate provides smooth and creamy texture to the formulation and are good for masking the unpleasant taste associated with some drugs. Also, good oral drug delivery system to gives therapeutic effect.

Also, it can be concluded that the F3 batch as an optimized batch, provides sweetening property as compare to others, pH & stability profile to be satisfactory.

pH Appereance of dark chocolate is about 6.3 to 6.8 The presence of desired compound that shows acceptable result. General apperenace are evalution test, weight variance test, Physical appearance.

Summary

By using prepared extract medicated chocolate prepared and evaluated for general appearance, dimension, hardness, blooming test, drug content determination and physical stability.

Beetroot is also a rich source of minerals and dietary fiber. Beetroot has several health benefits. Beetroot is loaded with excellent antioxidant properties and can highly stops the extension or growth of liver cancer and colon cancer cells. Beetroot have the ability to be used as a value-added constituent in many food products. It also contains high amount of iron, calcium and phosphorus.

Herbal extracts of brahmi powder was successfully formulated in the Chocolateformulations and contain the active constituents i.e. bacoside - A, bacoside - B, alkaloids, glycosides, flavonoids, saponins Studies have suggested that eating chocolate,especially dark chocolate, could boost both memory and mood.

Cardamom has excellent medicinal properties such as antiseptic, carminative, digestive, diuretic, stimulant, stomachic, tonic and antispasmodic, antimicrobial and anti-inflammatory activities.

Moringa chocolate made from leaves contains Protein, fat, carbohydrate and energy which has brain, heart and digestive health may improves.

Future Scope

Herbal multivitamin chocolate could be a great way to combine the benefits of herbs and vitamins with the deliciousness of chocolate. It could potentially be a popular and healthy alternative to regular chocolate. And people would love it! With the growing focus on health and wellness, there is a rising demand for natural and functional food products. Herbal multivitamin chocolate fits perfectly into this trend by offering a tasty and convenient way to incorporate herbs and essential vitamins into our daily lives.

Here are a few potential areas of growth and opportunities for herbal multivitamin chocolate:

Health-conscious consumers: As more people prioritize their well-being, herbal multivitamin chocolate can appeal to those seeking healthier snack options. It can provide a guilt-free indulgence while delivering the benefits of herbs and vitamins.

Nutraceutical market: The global nutraceutical market, which includes functional foods like herbal supplements, is experiencing significant growth. Herbal multivitamin chocolate can tap into this market and cater to consumers looking for natural alternatives to traditional supplements.

Targeted formulations: By combining specific herbs and vitamins, herbal multivitamin chocolate can be tailored to address various health concerns. For example, a formulation with herbs known for their calming properties and vitamins that support stress management could target individuals seeking relaxation.

Collaboration with herbal medicine experts: Partnering with herbal medicine experts or traditional medicine practitioners can lend credibility to the product. Their knowledge and expertise can help create effective and well-researched formulations, attracting consumers who value evidence-based approaches.

Expansion into different markets: As herbal remedies and alternative medicine gain popularity worldwide, there is potential to expand the reach of herbal multivitamin chocolate beyond its current market.

Remember, these are just some potential areas for growth. The future scope of herbal multivitamin chocolate will depend on factors like consumer demand, product innovation, marketing strategies, and regulatory considerations. It's an exciting concept that can offer a unique and beneficial product to health-conscious individuals.

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