

Formulation And Evaluation of Multivitamin and Antioxidant Herbal Chocolate'

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Abstract— Multivitamin-and-antioxidant herbal chocolate is an emerging nutraceutical formulation that combines the nutritional richness of vitamins, minerals, and bioactive herbal ingredients with the palatability and functional properties of cocoa. This review highlights the growing interest in herbal-fortified chocolates as a convenient delivery system for health-promoting compounds.

Dark chocolate is Inherently rich in polyphenols such as flavonoids, catechins, and procyanidins, which exhibit potent antioxidant, cardioprotective, and neuroprotective activities. The incorporation of herbal constituents like moringa, ashwagandha, turmeric, cinnamon, amla, tulsi, and ginseng further enhances its antioxidant capacity, immunomodulatory effects, and micronutrient profile.

Multivitamin fortification improves metabolic functions, energy production, cognitive performance, and overall wellbeing.

Index Terms—Multivitamin, Antioxidant, Immune Boosting.

I. INTRODUCTION

Herbal foods are the richest source of minerals, vitamins, carbohydrates and oxidants and many other constituents present in it. E.g. citrus fruits have large source of vit C, and vit A Are found in carrots. Vegetables and fruits are extremely important in human nutrition.

They Provide us important nutrients, minerals, dietary fiber, antioxidants and other beneficial Phytochemicals. Vegetable is available almost throughout a year in a wide Variety and used Fresh, cooked and pickled. A growing number of scientific investigations have revealed that Vegetable

consumption is clearly linked with good health and reduced risk of diseases (Liu, 2003). In 2012, Boeing et al. published a detailed review on the association between the Intake of vegetables and fruits, and the risk of several chronic diseases. They study showed That a high daily intake of fruits and vegetables promotes good health. With the increasing Awareness of consumers about the nutritional importance of fruits and vegetables, the Consumption of these is rising day by day. Peels of vegetables and fruits are often thrown as Agro wastes, fed to livestock and utilized as fertilizers.

Argo wastes are produced in great

Amounts during industrial food processing and household usage. These wastes are highly Prone to microbial spoilage and therefore pose a serious threat to the environment. The food Wastes are needed to be managed and utilized beneficially. Many strategies are developed Which include the utilization of these wastes in food and non-food items. A recent study on the papaya peel and seed flours (Santos et al., 2014) showed these had high contents of Protein and fiber, and therefore can be used as alternative sources of nutrients.

The authors Further discussed that peels can be added into various foods to add value. Abdrabba and Hussein (2015) worked on the peels of red grape and reported that the peels had high content of calcium, magnesium, phosphorus and potassium. Underground vegetables are the precious Source of various nutrients, beneficial phytochemicals such as flavonoids, reducing sugars, Amino acids, tannins, saponins, phlobatannins, anthraquinones, carbohydrates, steroids, Phytosterol,

alkaloids, terpenoids, cardiac glycosides and chalcones. Scientific investigations Revealed the presence of a large number of biologically active phytochemicals in all parts of the plants such as stems, barks, peels, stalks, flowers, fruits, leaves, roots, latex, hulls, seeds, Fruit rinds and pods revealed that these possess antimicrobial, anticancer, antioxidant and hepatoprotective properties.

Most vitamins were discovered accidentally when researchers were attacking Specific diseases and not studying foods or medicine. For example, the disease “Beriberi “Was prevented by eating unpolished rice (*Oryza sativa*). This was concluded to be due to the Presence of thiamine also known as thiamine in the rice husk, which was later named as Vitamin B1. If the diet is devoid of vitamin C, a deficiency disease called scurvy develops. If it is in the early stages, by eating foods; which contain Vitamin C, the person will be cured from the disease. Vitamins are organic substances, required in small amounts for body Functioning and good health, which are found in the food we eat. Vitamins fall in two Categories: water soluble and fat soluble. The human body can manufacture only a few vitamins. Some foods, e.g., bread and milk, are Enriched, which means that vitamins are added. They are needed to help the body to use the Energy nutrients, maintain normal body tissue, and act as a regulator. The best way for a Healthy person to obtain needed vitamins is to eat a balanced diet. A daily diet of varied foods Can provide needed essential vitamins for maintaining a healthy body. As an insurance to Provide sufficient amount, vitamins in liquid

The preparation of herbal chocolate involves melting cocoa butter, mixing cocoa powder, milk powder, sugar or honey, herbal extracts, and vitamin premixes, followed by moulding and cooling. Herbal chocolates are popular because they are tasty, easy to consume, and provide better patient compliance compared to tablets or capsules. They are especially useful for children and elderly people who may dislike conventional medicines.

Antioxidants present in the chocolate help in preventing cell damage, aging, heart diseases, and other health problems caused by free radicals. Multivitamins support normal body functions such as metabolism, immunity, bone health, and skin care. Herbal ingredients like amla and tulsi improve immunity, while ashwagandha helps reduce stress and

fatigue.

Overall, multivitamin and antioxidant herbal chocolate is considered a healthy functional food with both therapeutic and nutritional value. It has a growing demand in the nutraceutical and pharmaceutical industries due to increasing awareness about health, wellness, and natural products.

Multivitamin Antioxidant Herbal Chocolate is an innovative nutraceutical formulation developed by combining the nutritional richness of chocolate with the therapeutic properties of herbal ingredients, antioxidants, and essential multivitamins. In recent years, the demand for functional foods and nutraceutical products has increased significantly due to growing health awareness among people. Consumers are now more interested in products that not only provide taste and satisfaction but also contribute to maintaining good health and preventing diseases. Herbal chocolate is one such modern formulation that offers both health benefits and excellent palatability.

Chocolate, especially cocoa-based chocolate, is naturally rich in flavonoids, polyphenols, and antioxidant compounds that help protect the body from oxidative stress caused by free radicals. Oxidative stress is one of the major causes of aging, weakness, low immunity, and several chronic disorders. The incorporation of antioxidants and herbal extracts into chocolate enhances its medicinal value and transforms it into a health-promoting product. Herbal ingredients such as Ashwagandha, Tulsi, Ginger, and Turmeric possess various pharmacological activities including antioxidant, anti-inflammatory, immunomodulatory, and stress-relieving properties.

These herbs have been widely used in traditional systems of medicine for maintaining overall wellness and improving body resistance against diseases.

Multivitamins are essential micronutrients required for proper growth, metabolism, energy production, immune function, and maintenance of body tissues. Deficiency of vitamins may lead to weakness, fatigue, poor immunity, and nutritional imbalance. Therefore, incorporation of multivitamins into herbal chocolate provides an additional nutritional advantage and makes the product more beneficial for daily health supplementation. The prepared formulation acts as a convenient dosage form for delivering nutrients and herbal actives in an attractive and easily acceptable

manner, especially for children and individuals who dislike conventional tablets or capsules.

The present project focuses on the formulation and evaluation of multivitamin antioxidant herbal chocolate as a novel nutraceutical product. The formulation is designed to provide nutritional supplementation, antioxidant protection, and herbal therapeutic benefits while maintaining good taste, texture, and consumer acceptability. The use of natural ingredients and herbal extracts also minimizes the chances of adverse effects associated with synthetic preparations. Moreover, herbal chocolates can improve patient compliance because of their pleasant flavor and ease of administration.

The preparation of herbal chocolate involves careful selection of ingredients, controlled melting and mixing processes, incorporation of herbal extracts and multivitamins, followed by moulding and cooling. Proper formulation techniques are necessary to maintain stability, texture, flavour, and antioxidant activity of the product. Evaluation parameters such as appearance, taste, Odor, texture, pH, stability, and antioxidant activity are important to ensure the quality and effectiveness of the prepared chocolate.

Thus, multivitamin antioxidant herbal chocolate represents a promising combination of nutrition and herbal therapy in a modern dosage form. It can serve as a healthy alternative to conventional confectionery products and may contribute to improved immunity, better health, enhanced energy levels, and overall well-being. The formulation also reflects the growing trend toward natural, safe, and health-oriented food products in the nutraceutical and pharmaceutical industries.

II. ADVANTAGES OF HERBAL FOODS

1. **Rich in Nutrients and Bioactive Compounds:** Many herbs are packed with essential vitamins (A, C, and K), minerals, and powerful antioxidants like polyphenols and flavonoids.
2. **Disease Prevention and Management:** Regular consumption is linked to a lower risk of chronic conditions, including:
 - a. **Diabetes and Heart Health:** Herbs like garlic, fenugreek, and cinnamon may help lower cholesterol, blood pressure, and blood sugar levels.
 - b. **Anti-inflammatory Effects:** Plants such as

turmeric (curcumin), ginger, and basil contain natural anti-inflammatories that can ease joint pain and reduce cell damage.

- c. **Immune and Mental Support:** Adaptogens like ashwagandha and holy basil are used to reduce stress, improve sleep, and boost the immune system.
3. **Healthier Flavouring:** Using herbs and spices reduces the need for unhealthy additives like salt, sugar, and saturated fats in cooking.

Disadvantages and Risks

1. **Lack of Regulation:** Unlike pharmaceutical drugs, herbal products (especially supplements) are often not strictly regulated for purity or potency, leading to potential contamination with heavy metals, pesticides, or microbes.
2. **Dangerous Drug Interactions:** Herbs can significantly alter how the body processes conventional medications. For example:
3. **Unsafe for Specific Groups:** Many herbs are unsafe for pregnant or breastfeeding women, as they may have teratogenic effects or influence hormone levels

Role of Multivitamins

- Multivitamins play an important role in herbal chocolate by enhancing its nutritional and health value.
- They provide essential vitamins such as Vitamin A, B-complex, C, D, and E, which are necessary for proper body functioning.
- These vitamins help boost immunity, improve energy production, support brain and nervous system function, maintain healthy skin and bones, and protect the body from nutritional deficiencies.
- In herbal chocolate, multivitamins work together with herbal ingredients and antioxidants to improve overall health and wellness.

Role of Antioxidants

- Antioxidants play a vital role in herbal chocolate by protecting the body against harmful free radicals that cause cell damage and oxidative stress. Ingredients such as cocoa, amla, green tea extract, turmeric, and vitamins C and E are rich in antioxidants.
- These substances help reduce aging, improve

immunity, support heart health, and lower the risk of diseases like cancer and diabetes.

- Antioxidants also improve skin health and enhance overall body function. In herbal chocolate, they provide both nutritional and therapeutic benefits while making the product healthy and enjoyable to consume.

Uses

- Nutritional supplement.
- Immunity booster.
- Antioxidant support. Helps reduce fatigue and weakness.
- Promotes overall health and wellness.

Scope of the Project

- The scope of Multivitamin Antioxidant Herbal Chocolate is increasing rapidly in the nutraceutical and functional food industry.
- The product can be developed as a healthy confectionery supplement for all age groups. Due to its nutritional and therapeutic value, it has wide applications in health promotion, immunity enhancement, and antioxidant therapy.

Significance of the Project

- This project is significant because it combines nutrition, herbal medicine, and confectionery technology in a single formulation.
- It provides an innovative way to deliver herbal extracts and multivitamins through a tasty and consumer-friendly dosage form.
- The project also supports the concept of preventive healthcare by providing antioxidants and essential nutrients required for maintaining good health.

Nutraceutical Importance

- Nutraceutical products are gaining popularity because they provide medicinal benefits along with nutritional value.
- Herbal chocolate acts as a nutraceutical product that may help prevent nutritional deficiencies and oxidative stress-related disorders
- The presence of antioxidants and vitamins helps improve immunity and supports healthy body functioning

Health Benefits of Cocoa

- Cocoa is one of the major ingredients in herbal chocolate and contains natural antioxidant compounds such as flavonoids and polyphenols.
- These compounds help improve blood circulation, reduce oxidative damage, and support cardiovascular health.

III. LITERATURE REVIEW

Multivitamin and antioxidant herbal chocolate

1. Abiding A., et al., 2023 — Fortification of chocolates with high-value- added plant-based substances a recent, open review of approaches to fortify chocolates with plant extracts and functional ingredients, covering benefits, processing challenges, and stability concerns. Useful for formulation strategy and literature background.
2. Magrone T., et al., 2017 — Cocoa and dark chocolate polyphenols: from biology to clinical applications a well-cited review summarizing cocoa flavanols' antioxidant and anti- inflammatory mechanisms and clinical endpoints studied to date. Good source for mechanistic justification for antioxidant chocolate.
3. Baker LD., et al., 2023 — Effects of cocoa extract and a multivitamin on cognitive outcomes (COSMOS-Mind) — COSMOS-Mind nested analyses examining whether cocoa extract ± multivitamin impacted cognition in older adults; helps show what clinical evidence exists when cocoa extract and multivitamins are tested in the same trial framework
4. Alkurd RA., et al., 2023 — Evaluation of a commercial chocolate fortified with vitamins & minerals — product-evaluation paper (physicochemical, nutritional
5. Sorrenti V., et al., 2020 — Cocoa polyphenols and gut microbiota interplay — important for mechanism: many cocoa polyphenols are metabolized by gut microbes; this affects bioavailability and potential systemic effects when delivered via food matrices like chocolate. Helpful background to explain why matrix/formulation matters.

6. Samanta S., 2022 & Singh PK., 2024 — Review overviews — contemporary overviews of dark chocolate's functional potential and fortification approaches; good secondary sources summarizing recent small-scale studies and fortification methods. "Formulation and Evaluation of Multivitamin and Antioxidant Herbal Chocolate" — (IJPR / institutional project PDFs, various authors, 2024–2025) Multiple student/research project reports present formulations combining Ashwagandha, Amla (*Emblica officinalis*), beetroot, and vitamin premixes; report physical, organoleptic and antioxidant assays (DPPH/TAC) showing improved antioxidant capacity vs control chocolate. (Several open PDFs from academic journals/repositories.)

7. Sohel, S.M. (2024) — "Formulation and Evaluation of Herbs Infused Chocolate" (open access article)

8. Evaluates liquorice, Tulsi, and Moringa extracts in dark chocolate; measures antioxidant markers and suggests liquorice as an alternative sweetener with glycaemic benefits.

9. Ijarsat / Formulation evaluation (2025) — "Multivitamin and Antioxidant

10. Herbal Chocolate" (conference/college paper)

IV. AIM AND OBJECTIVE:

Aim: Formulation and Evaluation of Multivitamin Antioxidant Herbal Chocolate

Objective:

- To provide a convenient source of essential vitamins.
- To incorporate natural antioxidants
- To improve overall health and immunity.
- To support metabolic and physiological functions.
- To prevent micronutrient deficiencies.
- To create a safe, natural alternative to synthetic supplements.
- To develop a palatable nutraceutical formulation.

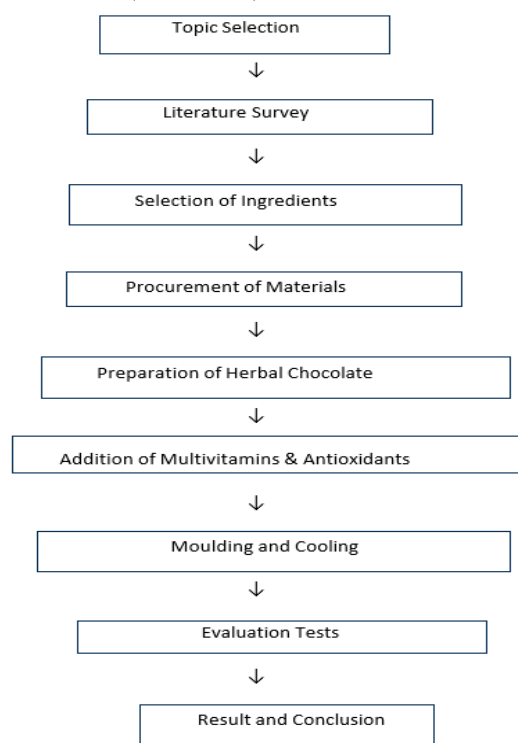
Need of Project

- Increasing demand for healthy nutraceutical products.

- Need for easy and tasty dosage forms for herbal supplements.
- To provide antioxidants and vitamins in an attractive form.
- Helpful for boosting immunity and reducing oxidative stress.

Sambhajinagar

Plan of Work (Flow Chart)



Herbal drug formulation
Moringa Powder



Figure 1: Moringa Powder

Classification:

- Biological Name: *Moringa Oleifera*
- Biological source: The dried or fresh leaves, seeds,

Pods, and roots of Moringa

- Family: Moringaceae
- Common Name: Drumstick tree, Horseradish tree, Ben tree, Saguna.
- 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 Campesterol which are Precursors for hormones

Mechanism of Action of Moringa

Antioxidant Activity:

- Rich in quercetin, chlorogenic acid, vitamin C & E
- These compounds neutralize free radicals and reduce oxidative stress
- Anti-inflammatory Action: These inhibit NF- κ B and COX-2, reducing formation of inflammatory mediators.
- ↓ inflammation, ↓ swelling, ↓ pain.
- Immunomodulatory Action: Polysaccharides enhance macrophage & lymphocyte activity
- Strengthens overall immunity.
- Uses: Anti-inflammatory, Anti-oxidant, improve Immunity.

Beetroot Powder:



Figure 2: Beetroot Powder

- Classification: Biological Name: Beta vulgaris L. Biological Source: It is the edible taproot portion of the Beta vulgaris plant, specifically the Conditiva Group

Family: Amaranthaceae (formerly classified under the Chenopodiaceae or goosefoot family).

Chemical Constituents:

- Betalains: Beetroot owes its vibrant red colour to a group of antioxidants called betalains. These compounds, including betanin and violaxanthin, 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.

Mechanism of Action of Beetroot:

Helps prevent vitamin deficiencies

Supports metabolism, energy production, and hemoglobin formation

Vitamin A → Vitamin C → Boosts immunity, enhances iron absorption

Supports vision and immunity

Vitamin E → Acts as an antioxidant

Vitamin K → Helps in blood clotting

Uses: Digestive benefits, Anti-inflammatory, Antioxidant

Tulsi Powder:



Figure 3: Tulsi Powder

Classification:

Biological Name: Ocimum sanctum L.

Biological source: fresh or dried leaves and flowering tops of Ocimum sanctum

Family: Lemnaceae

Common Name: Holy Basil, Indian Basil

Chemical Constituents:

Vitamin C: Tulsi leaves are a good source of vitamin C, which is known for its immune boosting properties. Vitamin C: supports the immune system, aids in collagen production, and acts as an Antioxidant to protect cells from damage.

Vitamin A: Tulsi leaves also contain vitamin A, which is essential for maintaining healthy Vision, supporting the immune system, and promoting skin health.

Vitamin K: Tulsi contains vitamin K, which is necessary for proper blood clotting and bone Health.

Mechanism of Action of Tulsi:

- Rich in flavonoids, phenolic acids, and eugenol.
- Stimulates T cells, B cells, macrophages, Enhances antibody response. • Reduces cortisol levels, Improves stress tolerance and mental clarity
- Enhances insulin secretion and insulin sensitivity.
- Uses: Acts as a natural immune booster Antioxidant

Cinnamon Powder



Figure 4: Cinnamon Powder

Classification

- Biological Name: Cinnamomum verum J. Presl
- Biological Source: Cinnamon consists of the dried bark of Cinnamomum verum.
- Family: Lauraceae
- Common Name: Cinnamon, Dalchini (Hindi), Ceylon Cinnamon,

Chemical constituents:

- Cinnamon consists of a variety of resinous compounds, including cinnamaldehyde, Cinnamate, cinnamic acid, and numerous

essential oils.

- The spicy taste and fragrance are due to the presence of cinnamaldehyde and occur due to the absorption of oxygen.
- As cinnamon ages, it darkens in color, improving the resinous compounds.
- The presence of a wide range of essential oils, such as trans- cinnamaldehyde, cinnamyl Acetate, eugenol, L-borneol, caryophyllene oxide, b-caryophyllene, L- bornyl acetate, Eneerolidol, α -cubebene, α -terpineol, terpinolene, and α -thujene, has been observed

Mechanism of Action of Cinnamon:

Enhances Body's Endogenous Antioxidant Enzymes.

Improves metabolic functions, immune response, and cellular protection by supplying essential micronutrients.

Uses: Additional Micronutrients, Acts as a Natural Preservative

Cardamon:



Figure 5: Cardamon

Classification

- Biological Name: Elettaria cardamomum (L.) Maton
- Biological Source: consists of the dried ripe fruits of cardamon
- Family: zingiberaceae
- Common Name: Cardamomd, Elaichi

Chemical Constituents: - 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% [13]. 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.

Mechanism Of Action of Cardamon:

Membrane disruption + enzyme inhibition. Inhibition of inflammatory mediators

Uses: Anti-inflammatory, Antioxidant, Antiseptic
Jaggery powder:



Figure 6: Jaggery Powder

Classification

Biological Name: Sugarcane, *Saccharum officinarum* L., Date Palm Family: Poaceae (for sugarcane: *Saccharum officinarum*) Common Name: Jaggery Also known as Gur

Chemical constituents:

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 s 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 person's health.

Mechanism Of Action Jaggery:

- Antioxidant: Free radical scavenging + protection from oxidative damage.
- Antioxidant activity cleanses the blood and enhances flow.
- Energy Booster: Rapid absorption of natural sugars → ATP generation.

Uses: Detoxification, Immunity Booster, Rich in Minerals.

Dark Chocolate:



Figure 7: Dark Chocolate

Classification

- Biological Name: *Theobroma cacao* L.
- Biological source: fermented, dried, roasted, and processed seeds (cocoa beans)
- Family: Malvaceae
- Common Name: Dark Chocolate, cocoa, cacao chocolate
- Chemical constituents: 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.

V. MECHANISM OF ACTION CHOCOLATE

- Enhances insulin sensitivity.
- Reduces glucose uptake in the intestine.
- Antioxidants protect pancreatic β -cells

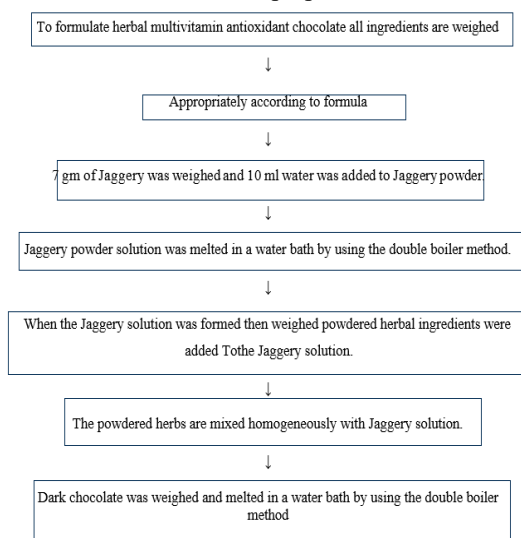
- Anti-inflammatory MOA
- Polyphenols inhibit inflammatory pathways

Uses: Mineral-rich: Magnesium, Iron, Copper, Potassium, Selenium

VI. METHOD OF PREPARATION:

Material: moringa, Tulsi, cinnamon, cardamon, jaggery, beetroot, dark choco, cocoa butter.

Method of preparation:



Extraction:

Extraction of beetroot

Cold Extraction (CE)

Dried and ground material (20 g) and solvent (250 mL) were added into a conical flask. Various solutions were employed as the solvent— (CE 50% MeOH), 50% aqueous methanol (CE 80% MeOH), 50% aqueous ethanol (CE 50% EtOH) and water (CE H₂O). To avoid constant stirring, magnetic grain was added to the mixture, and it was then placed on a magnetic stirrer. The extraction took place for about 2 h at room temperature

Obsevation table:

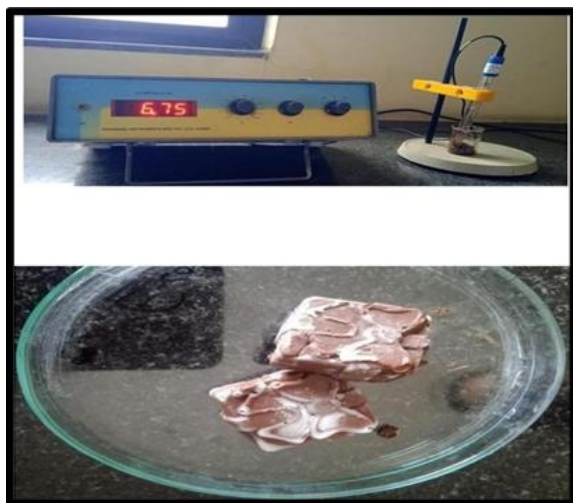
Formulation Code

Sr.no	Ingredients	F1	F2	F3	F4
1.	Moringa Powder	1	0.7	0.8	0.9
2.	Tulsi Powder	0.5	0.3	0.3	0.5
3.	Cinnamon powder	0.02	0.02	0.02	0.02
4.	Jaggery Powder	0.005	0.055	0.005	0.005
5.	Beetroot Powder	8	7	7	7
6.	Dark chocolate	2	2	1	1
7.	Cocoa Butter	15	15	15	15
8.	Cardamon powder	1	1	1	1

Sr. No	Ingredients	Uses
1	Moringa powder	Antioxidants
2	Beetroot powder	Heat boosting supplement
3	Tulsi powder	Improve immunity
4	innamon powder	Powerhouse of antioxidant
5	ardamon powder	Improve blood circulation
6	Dark chocolate	Contain antioxidants that can protect cells
7	Jaggery	Detox liver and blood



Figure 8: Ingredients Quantification for Herbal Formulation



Figure

Figure 9: PH Test

VII. EVALUATION TEST:

1. Organoleptic characters
2. phytochemical analysis.
3. Hardness.

Hardness of chocolate was measured by Monsanto Hardness Tester. 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 percent deviation.

$$\text{Percentage deviation} = \frac{\text{individual weight-final weight} \times 100}{\text{Average weight}}$$

4. Blooming test:

Fat Bloom – When the thin layer of fat crystals form on the surface of 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 fat 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 rough and irregular layer on top of chocolate formulation. This Is caused by condensation (when chocolate is taken out of the refrigerator). This moisture Will dissolve the sugar in the chocolate. When the water evaporates, sugar recrystallizes into rough, irregular crystals on surface. This results into unpleasant look. Test sample of chocolate was subjected to treatment cycles at 30°C for 11 hours Shifting Of temperature for 1 hour to 18 °C for 11 hours shifting of temperature for 1 hour. Observed the test sample of chocolate whether blooming has taken place or not.

Physical stability to check the physical stability, sample of chocolate was kept in closed container for 1 Month at 28°C after one month interval, Test sample of chocolate was observed for Physical appearance and drug degradation. patil pharmacy college, chh. Sambhajinagar

Moisture content the moisture content is defined as the amount of water present in food sample. For Determining the moisture content in the sample, dry empty Petri dish is weighed and then 2 g of sample is added to it and it is kept in hot air oven at 110o C for 2-3 hours. After the Given time the petri dish is kept in the desiccator to cool down and the weight is taken Using weighing balance. Calculation is done by the formula:

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the desicator to cool down and the weight is taken Using weighing balance. Calculation is done by the formula:

Moisture Content (%) = $W_2 - W_3 / W \times 100$ Where,

W = weight of sample (g)

W₂ = weight of empty petri dish (g) + sample

(g) W₃ = weight of the petri dish after drying

4. PH of chocolate formulation: -

1. Procedure for pH measurement: -

2. Rinse the electrode.

3. Electrode is calibrated by using distilled water till the pH become 7

4. Put the meter into measurement mode.

5. The electrode is inserted into the chocolate sample.

6. Readings are recorded



Figure 10: Phytochemical Analysis

Evaluation Parameter		Observation Table			
Sr no	Parameters	F1	F2	F3	F4
1	Colour	Brown	Brown	Brown	Brown
2	Odour	chocolaty	chocolaty	chocolaty	chocolaty
3	Taste	Sweet and slightly bitter	Sweet and slightly bitter	Sweet and slightly bitter	Sweet and slightly bitter
4	Mouth feel	Sweet and pleasant	Sweet and pleasant	Sweet and pleasant	Sweet and pleasant
5	Appearance	glossy	glossy	glossy	glossy

VIII. DIMENTIONS

It was measured by Vernier's callipers

Avg. Width of 4 chocolate formulations: $1.85 + 1.84 + 1.85 + 1.86 / 4$ The average width of 4 chocolate is observed to be = 1.86

Weight variation determination: - Average Weight of 4 formulations: $W_1 + W_2 + W_3 + W_4 / 4$ Average weight calculated to be (for batch 3) = $5.9 + 5.6 + 5.7 + 5.9 / 4$ Average weight calculated to be (for batch 3) = 5.78gm Similarly weight variations for other 1 batch was also calculated

Parametre	F1	F2	F3	F4
Average weight	6.02gm	5.82gm	5.78gm	5.68gm



Figure 11: Dimensions of Chocolate

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: - F4 batch was selected for stability study. 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

Parameters	Storage condition	At the time of preparation	after the one month
Colour, odour, taste, mouthfeel, appearance	2-8	Brown, chocolaty, slightly bitter, glossy	No change

$$\text{Moisture Content (\%)} = \frac{W_2 - W_3}{W} \times 100$$

$$= \frac{44 - 43.5}{42} \times 100 = 15\%$$

PH	F1	F2	F3	F4
	6.9	6.7	6.67	6.5

IX. RESULT

The formulated Antioxidant and Multivitamin Herbal Chocolate was successfully prepared and evaluated for its physical and nutritional properties. The chocolate showed a smooth texture, pleasant aroma, attractive appearance, and acceptable taste. The incorporation of herbal ingredients and multivitamins enhanced its nutritional and antioxidant value without affecting the

overall quality of the chocolate.

The pH of the formulation was found to be within an acceptable range, indicating good stability of the product. The prepared chocolate also exhibited good hardness, uniformity, and no visible microbial contamination during storage. Presence of antioxidant-rich herbal ingredients may help in improving immunity, reducing oxidative stress, and providing health benefits along with consumer acceptability. Overall, the developed herbal chocolate can be considered a promising nutraceutical product with both nutritional and therapeutic potential

Evaluation Parameter		Observation Table			
Sr no	Parameters	F1	F2	F3	F4
1	Colour	Brown	Brown	Brown	Brown
2	Odour	chocolaty	chocolaty	chocolatyX	chocolaty
3	Taste	Sweet and slightly bitter	Sweet and slightly bitter	Sweet and slightly bitter	Sweet and slightly bitter
4	Mouth feel	Sweet and pleasant	Sweet and pleasant	Sweet and pleasant	Sweet and pleasant
5	Appearance	glossy	glossy	glossy	glossy



X. CONCLUSION

In the present study, development of Pediatric Herbal Chocolate having antioxidant activity was Carried out. beetroot leaves were prepared and phytochemical analysis was Carried out to check the presence of desired compounds that shows the acceptable results. By Using prepared extract medicated chocolate prepared and evaluated for general appearance, Dimension, hardness, blooming test, drug content determination and physical stability. From Above study, we concluded that the chocolate provides smooth and creamy texture to the Formulation and are good for masking the unpleasant taste with multivitamin-and- antioxidant properties chocolate provides formulation and are good for masking the unpleasant taste Also, good oral drug delivery system to gives therapeutic effect



Figure 14: Final Product

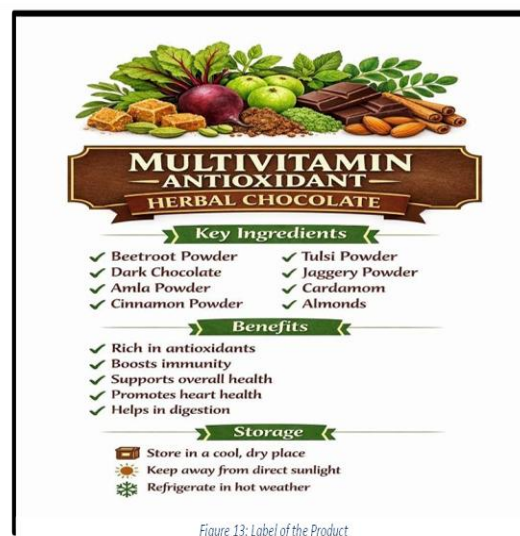


Figure 13: Label of the Product

XI. DISCUSSION

Studies and reviews report that properly formulated functional chocolates can increase plasma polyphenols and antioxidant capacity and can be used to carry vitamins, plant extracts, probiotics and other nutraceuticals. In this Palatable delivery: chocolate (particularly dark chocolate) masks bitterness, improves adherence versus pills, and is widely accepted as a snack-like vehicle.

cocoa butter and other lipids protect lipophilic vitamins and many phytochemicals from oxidation and can improve oral absorption of fat-soluble nutrients. Cocoa itself provides flavanols and methylxanthines that add antioxidant, vascular and cognitive support and may act synergistically with added botanicals and vitamins.

Found Expected benefits:

- Improved micronutrient status: regular consumption of fortified chocolate can increase intake of targeted vitamins
- Antioxidant effects: combined cocoa polyphenols + herbal antioxidants (e.g: Moringa powder, beetroot powder, cinnamon)
- Cardiometabolic support: cocoa flavanols and some botanical polyphenols have evidence for modest improvements in endothelial function, blood pressure and insulin sensitivity — benefits that may be additive with antioxidant vitamins
- Consumer compliance: better sensory acceptance increases the chance people will take their supplements consistently.

Fat-soluble vitamins Found like:

- Vitamin A (retinol/ β -carotene) — vision, immune function; storeable but toxic at high doses.
- Vitamin D (D3/cholecalciferol) — bone health, immune modulation; often included when deficiency is common.
- Vitamin K — blood clotting, bone metabolism (include cautiously if target group uses anticoagulants).

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