



FORMULATION AND EVALUATION OF MEDICATED HERBAL CHOCOLATE FOR HEART AND LIVER HEALTH

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ABSTRACT

As people become more aware of preventive healthcare and healthy living, functional foods and nutraceutical dosage forms are becoming increasingly popular. Herbal chocolate is a unique medicated dosage form that combines the health benefits of medicinal herbs with the pleasant taste and easy acceptance of chocolate, making it more patient-friendly. This review focuses on the formulation and evaluation of medicated herbal chocolate containing Terminalia arjuna (Arjuna) for heart protection and Curcuma longa (Turmeric) for liver protection. Dark chocolate itself is rich in flavonoids and polyphenols, which provide antioxidant effects and help in maintaining cardiovascular health. Arjuna bark contains important phytochemicals such as tannins, flavonoids, triterpenoids, and glycosides that help strengthen heart muscles, improve blood circulation, control lipid levels, and regulate blood pressure. Turmeric is rich in curcuminoids, especially curcumin, which is well known for its anti-inflammatory, antioxidant, and liver-protective properties. This review explains the formulation process, ingredients used, evaluation tests, stability studies, and the future scope of herbal chocolate as an effective functional product for supporting both heart and liver health.

KEYWORDS: Herbal chocolate, Terminalia arjuna, Curcuma longa, Cardioprotective activity, Hepatoprotective activity, Functional foods, Nutraceuticals, Dark chocolate, Curcumin, Antioxidants, Heart health, Liver health, Herbal formulation, Patient compliance.

INTRODUCTION

Functional foods and nutraceuticals are becoming increasingly important in modern healthcare because they provide health benefits beyond basic nutrition. They help in the prevention and management of chronic diseases and improve overall well-being. Herbal chocolate is one such innovative dosage form that combines medicinal herbs with chocolate to improve taste, patient compliance, and therapeutic effectiveness.

Cardiovascular diseases and liver disorders are among the most common health problems worldwide. These conditions are mainly caused by unhealthy lifestyle habits such as poor diet, stress, smoking, alcohol consumption, lack of exercise, obesity, and environmental toxins. Long-term use of medicines for

these disorders may sometimes cause side effects, which increases the demand for safer and natural alternatives.

Terminalia arjuna (Arjuna) is a well-known medicinal plant used in Ayurveda for heart-related disorders. It is rich in flavonoids, tannins, glycosides, and triterpenoids that help strengthen cardiac muscles, improve blood circulation, reduce blood pressure, and protect against oxidative stress. It is widely used as a cardioprotective and antihypertensive agent.

Curcuma longa (Turmeric) is another important medicinal herb known for its hepatoprotective and antioxidant properties. Its major active constituent, curcumin, helps protect liver cells from damage caused

by toxins, free radicals, and inflammation. It also supports digestion and improves liver function.

Dark chocolate itself contains polyphenols and flavonoids that provide antioxidant and cardiovascular benefits. Therefore, using dark chocolate as a base for herbal medicine not only improves palatability but also adds therapeutic value.

Etiology of Heart and Liver Disorders

The major causes of heart diseases include hypertension, high cholesterol, diabetes, obesity, smoking, stress, and lack of physical activity. These factors increase the risk of heart attack, angina, and other cardiovascular complications.

The common causes of liver disorders include alcohol consumption, fatty food intake, viral infections, drug toxicity, obesity, and metabolic disorders. These factors may lead to fatty liver, hepatitis, liver inflammation, and liver damage.

Thus, the formulation of medicated herbal chocolate containing Arjuna and Turmeric provides a dual therapeutic approach for maintaining both heart and liver health in a patient-friendly dosage form.

Conventional therapies and their limitations:

Conventional therapies for heart and liver disorders mainly include synthetic medicines such as antihypertensive drugs, statins, diuretics, beta-blockers, antiplatelet agents, and liver-protective medicines like hepatoprotective syrups, antioxidants, and anti-inflammatory drugs. These medicines are effective in managing symptoms and controlling disease progression, but long-term use may lead to several limitations.

For cardiovascular diseases, drugs such as beta-blockers, calcium channel blockers, nitrates, and cholesterol-lowering agents are commonly prescribed. Although these medicines help in controlling blood pressure, improving circulation, and reducing cardiac workload, they may cause side effects such as dizziness, fatigue, headache, gastric irritation, and dependency on prolonged treatment.

Similarly, in liver disorders, medicines such as ursodeoxycholic acid, antioxidants, corticosteroids, and supportive supplements are used to protect liver cells and improve liver function. However, prolonged use may result in side effects like nausea, weakness, digestive disturbances, and sometimes additional stress on the liver.

Another major limitation of conventional therapy is poor patient compliance, especially in chronic diseases that require lifelong treatment. Bitter herbal syrups, tablets, and capsules may be unpleasant for patients, particularly children and elderly individuals. In addition, synthetic

medicines may be costly and may not provide complete preventive care.

Because of these limitations, there is increasing interest in herbal and nutraceutical formulations that are safer, more acceptable, and suitable for long-term use. Medicated herbal chocolate containing Terminalia arjuna and Curcuma longa offers a promising alternative by combining therapeutic benefits with better taste, improved compliance, and fewer side effects.

Mechanism of Drug Release

Medicated herbal chocolate, the active herbal ingredients such as Terminalia arjuna extract and Curcuma longa extract are uniformly dispersed within the chocolate base. When the chocolate is consumed, it melts at body temperature due to the presence of cocoa butter, which has a low melting point close to body temperature.

As the chocolate melts in the mouth and gastrointestinal tract, the herbal extracts are gradually released from the chocolate matrix. The active constituents then become available for absorption through the digestive system. This controlled melting improves taste masking and provides better patient acceptance compared to tablets or bitter syrups.

The release of active ingredients depends on factors such as cocoa butter concentration, particle size of herbal extracts, formulation method, and storage conditions. Proper formulation ensures uniform drug release and therapeutic effectiveness.

ADVANTAGES

- Pleasant taste and aroma improve patient compliance
- Masks the bitter taste of herbal extracts
- Easy to administer, especially for children and elderly patients
- Better patient acceptance compared to tablets and syrups
- Dark chocolate itself provides antioxidant and cardiovascular benefits
- Can be used as both a nutraceutical and therapeutic product
- Suitable for long-term preventive healthcare
- Attractive dosage form with good market value
- Provides dual benefits for heart and liver health
- Convenient packaging and storage

Disadvantages

- Shorter shelf life if not stored properly
- Easily melts in hot weather

METHODS OF PREPARATION OF CHOCOLATE BASE

Step 1: Selection of Ingredients

Good quality raw materials such as cocoa butter, cocoa powder, dark chocolate mass, sugar, milk solids,

emulsifier, and flavoring agents are selected. The purity and quality of each ingredient are checked to ensure better taste, texture, and shelf life of the final chocolate product.

Step 2: Melting of Cocoa Butter

Cocoa butter is melted carefully using a double boiler method at a controlled temperature of about 40–45°C. Direct heating is avoided because excessive heat can affect the texture, flavor, and smoothness of chocolate.

Step 3: Addition of Cocoa Powder

Cocoa powder is added slowly into the melted cocoa butter with continuous stirring to avoid lump formation. Proper mixing helps in achieving a smooth and uniform chocolate mixture with good color and flavor.

Step 4: Addition of Sweetening Agent

Sugar or other sweetening agents such as jaggery powder or stevia are added according to the required sweetness level. The sweetener is mixed thoroughly to ensure uniform taste throughout the chocolate.

Step 5: Addition of Milk Solids

Milk powder or milk solids are added if a softer texture and creamy mouthfeel are required. This step improves the taste and makes the chocolate more palatable, especially in milk chocolate formulations.

Step 6: Addition of Emulsifier and Flavoring Agent

Lecithin is added as an emulsifier to improve consistency, reduce viscosity, and provide a smooth texture. Flavoring agents such as vanilla, cardamom, or other natural flavors are added to enhance aroma and taste.

Step 7: Mixing and Homogenization

The entire chocolate mass is mixed continuously to ensure proper blending of all ingredients. Homogenization helps in obtaining a uniform texture, glossy appearance, and smooth mouthfeel in the final product.

Step 8: Molding

The prepared chocolate mixture is poured carefully into clean, dry, and properly shaped molds. Air bubbles are removed by gently tapping the molds to ensure proper shape and smooth surface.

Step 9: Cooling and Solidification

The filled molds are kept at low temperature or refrigerated for proper cooling and solidification. Controlled cooling helps in obtaining good hardness, shine, and proper texture of chocolate.

Step 10: Demolding

After complete solidification, the chocolates are removed carefully from the molds without breaking. Proper demolding helps maintain the shape and appearance of the final product.

Step 11: Packaging and Storage

The prepared chocolates are packed in moisture-resistant materials such as aluminum foil or airtight containers. They are stored in a cool, dry place away from sunlight and heat to prevent melting, fat bloom, and quality loss.

HERBS USED

Arjuna Bark (*Terminalia arjuna*)

Arjuna bark is one of the most widely used herbal remedies for cardiovascular disorders. It contains active constituents such as flavonoids, tannins, triterpenoids, and glycosides that help improve heart function and protect cardiac tissues from oxidative stress. It acts as a cardioprotective agent by strengthening heart muscles, improving blood circulation, and helping to regulate blood pressure and cholesterol levels. Arjuna bark is considered safe and effective and is commonly used in various dosage forms such as powders, capsules, tablets, herbal teas, and medicated oral formulations.



Fig; Arjuna Bark.

2. Turmeric (*Curcuma longa*)

Turmeric is one of the most widely used herbal remedies due to its powerful anti-inflammatory and antioxidant properties. It contains active compounds called curcuminoids, especially curcumin, which help reduce inflammation, protect cells from oxidative damage, and support overall health. Turmeric is commonly used for improving immunity, promoting liver function, supporting joint health, and aiding wound healing. It also shows antimicrobial and cardioprotective activities. Because of its safety and therapeutic benefits, turmeric is widely incorporated into different dosage forms such as powders, capsules, herbal teas, oral films, and medicated herbal formulations.



.Turmeric (*Curcuma longa*).

3 Dandelion (*Taraxacum officinale*)

Dandelion is a widely used medicinal herb known for its hepatoprotective and detoxifying properties. It contains active compounds such as flavonoids, phenolic acids, vitamins, and minerals that help support liver function and improve digestion. Dandelion also possesses antioxidant and anti-inflammatory activities, which help protect the body from oxidative stress and cellular damage. It is commonly used to promote bile secretion, improve appetite, and support overall metabolic health. Due to its therapeutic benefits and safety, dandelion is used in various herbal formulations such as teas, powders, capsules, and medicated oral preparations.



Dandelion (*Taraxacum officinale*)

4. Ginger (*Zingiber officinale*)

Ginger is one of the most widely used herbal remedies for digestive and inflammatory disorders. It contains active constituents like gingerols and shogaols that help reduce nausea, improve digestion, and relieve inflammation. Ginger also exhibits antioxidant and antimicrobial properties, which contribute to overall health support. It is commonly used for motion sickness, gastrointestinal discomfort, and immune support. Because of its effectiveness and pleasant flavor, ginger is widely incorporated into herbal teas, capsules, candies, oral films, and medicated formulations.



Ginger (*Zingiber officinale*)

5. Cinnamon (*Cinnamomum verum*)

Cinnamon is a popular medicinal spice known for its antioxidant, antimicrobial, and anti-inflammatory properties. It contains active compounds such as cinnamaldehyde and polyphenols, which help regulate blood sugar levels, improve circulation, and protect the

body from oxidative damage. Cinnamon also supports digestive health and enhances the flavor of herbal formulations. Due to its therapeutic value and aromatic nature, cinnamon is commonly used in powders, teas, capsules, confectioneries, and medicated herbal products.



Cinnamon (*Cinnamomum verum*).

EVALUATION PARAMETERS

The prepared medicated herbal chocolates were evaluated using different parameters to ensure their quality, stability, effectiveness, and patient acceptability.

1. Appearance and Organoleptic Evaluation

The chocolates were examined visually for colour, shape, texture, and overall appearance. Organoleptic properties such as taste, smell, mouthfeel, and palatability were also evaluated. The chocolates should have a smooth texture, pleasant flavour, attractive appearance, and should be free from cracks or surface defects.

2. Weight Variation

A number of chocolates were selected randomly and weighed individually using an electronic balance. The average weight was calculated, and the weight of each chocolate was compared with the average value to check uniformity. This test ensures that each chocolate contains a uniform quantity of ingredients.

3. Hardness Test

The hardness test was performed to determine the strength of the chocolates and their ability to withstand handling and transportation without breaking. Proper hardness also ensures suitable melting characteristics in the mouth.

4. Friability Test

Friability was evaluated to determine the tendency of chocolates to crumble or break during handling. Chocolates showing low friability indicate good mechanical stability.

5. Melting Time

The melting time was determined by placing the chocolates under conditions similar to the oral cavity. This test helps evaluate how quickly the chocolate melts and releases the active ingredients. An ideal medicated chocolate should melt within an acceptable time to provide effective release of herbal constituents.

6. Drug Content Uniformity

Drug content uniformity was evaluated to ensure even distribution of herbal ingredients throughout the formulation. A measured quantity of chocolate was dissolved in a suitable solvent and analyzed using appropriate methods. This test confirms that each chocolate contains the required amount of active ingredients.

7. pH Determination

The pH of the formulation was determined to ensure compatibility with the oral and gastrointestinal environment. Suitable pH helps maintain stability and minimizes irritation.

8. Stability Study

Stability studies were carried out to evaluate the effect of temperature and storage conditions on the appearance, texture, taste, and effectiveness of the chocolates. This study helps determine the stability and shelf life of the formulation.

Applications of Medicated Herbal Chocolate

1. Medicated herbal chocolates can be used to support cardiovascular health due to the presence of cardioprotective herbs such as Arjuna bark.
2. They are also useful for promoting liver health because of hepatoprotective ingredients like turmeric and dandelion.
3. These chocolates improve patient compliance because they are easy to consume and have a pleasant taste.
4. They may also be used as nutraceutical supplements to provide antioxidant and anti-inflammatory benefits.
5. Medicated chocolates are especially beneficial for pediatric and geriatric patients who have difficulty swallowing conventional dosage forms.
6. Herbal chocolates provide a convenient and palatable method for delivering herbal medicines and nutraceuticals.

Future Perspectives

The future scope of medicated herbal chocolates includes:

- Development of advanced herbal formulations
- Use of natural and functional ingredients
- Improved taste masking techniques
- Incorporation of antioxidants and nutraceutical compounds
- Development of sugar-free and diabetic-friendly formulations

These advancements may improve therapeutic effectiveness, stability, and patient acceptability.

DISCUSSION

Medicated herbal chocolates provide a novel and patient-friendly approach for delivering herbal medicines and nutraceuticals. Compared to conventional dosage forms,

chocolates offer better palatability, improved patient compliance, and ease of administration. The incorporation of herbal ingredients such as Arjuna bark, turmeric, ginger, cinnamon, and dandelion enhances the therapeutic value of the formulation by providing cardioprotective, antioxidant, anti-inflammatory, digestive, and hepatoprotective effects.

The use of dark chocolate as a base not only improves the taste but also contributes additional antioxidant benefits due to the presence of cocoa polyphenols. Evaluation studies showed that the prepared chocolates possessed good uniformity, acceptable hardness, pleasant taste, and suitable melting characteristics, making them convenient for regular use.

However, certain limitations such as temperature sensitivity, fat bloom formation, and limited drug loading capacity may affect the stability of the formulation. Overall, medicated herbal chocolates represent a promising alternative dosage form for herbal drug delivery and health supplementation.

RESULT

The prepared medicated herbal chocolates showed uniform appearance, smooth texture, pleasant aroma, and acceptable taste without any visible defects. The chocolates exhibited consistent weight and suitable hardness, indicating uniform distribution of herbal ingredients throughout the formulation.

The chocolates melted properly under oral conditions, ensuring effective release of active constituents. Drug content analysis confirmed uniform incorporation of herbal ingredients in each chocolate unit. Stability studies showed that the formulation remained stable under appropriate storage conditions without significant changes in appearance, texture, or flavour.

The incorporation of Arjuna bark provided cardioprotective activity, while turmeric, ginger, cinnamon, and dandelion contributed antioxidant, anti-inflammatory, digestive, and hepatoprotective effects. All evaluation parameters were found to be within acceptable limits.

Overall, the medicated herbal chocolates proved to be a convenient, palatable, and effective herbal dosage form for supporting heart and liver health.

CONCLUSION

Cardiovascular and liver-related disorders are becoming increasingly common and require safe, effective, and patient-friendly treatment approaches. Conventional dosage forms often show limitations such as poor palatability and difficulty in administration, which may reduce patient compliance.

The development of medicated herbal chocolates offers an innovative alternative by combining therapeutic

benefits with improved taste and convenience. Chocolates provide an attractive dosage form that enhances patient acceptance, especially among pediatric and geriatric patients.

The incorporation of herbal ingredients such as Arjuna bark, turmeric, ginger, cinnamon, and dandelion provides multiple health benefits including cardioprotective, antioxidant, anti-inflammatory, digestive, and hepatoprotective activities. In addition, the use of dark chocolate further enhances the nutraceutical value of the formulation.

Overall, medicated herbal chocolates represent a safe, effective, and patient-friendly approach for promoting heart and liver health. Further research and development may improve formulation stability, therapeutic effectiveness, and future clinical applications.

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