



A Review On Formulation And Evaluation Of Pediatric Herbal Chocolate

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Abstract:

The aim of this study is to develop a pediatric-friendly herbal chocolate by combining medicine with one of children's favorite foods, chocolate, to make treatment more appealing. Cough and viral infections are common among children, and *Ocimum sanctum* (Tulsi), a well-known herbal remedy, has significant medicinal properties, including antitussive (cough-relieving) effects. The goal is to create a chocolate formulation containing an aqueous extract of Tulsi that provides these therapeutic benefits. The formulated medicated chocolate will be evaluated for various factors, including appearance, size, hardness, bloom (fat stability), drug content, and physical stability.

Chocolate, being a versatile food, allows for a variety of taste and texture combinations. Additionally, it serves as an anhydrous medium, preventing microbial growth and reducing the risk of hydrolysis of water-sensitive medicinal agents. Chocolate is rich in beneficial compounds like saturated fats, polyphenols, sterols, and methylxanthines. It also contains phenyl ethylamine, a compound naturally present in the brain, known as the "love drug" for its ability to induce feelings of happiness and contentment. In chocolate, phenyl ethylamine can elevate blood pressure and sugar levels, promoting a sense of well-being.

Humans typically experience five basic taste sensations: sweet, sour, bitter, salty, and savory, with sweet being one of the most enjoyable. Sweetness, especially from high-calorie saccharides, plays a key role in making the formulation appealing, particularly for children.

Keywords: Viral infection, chocolate, pediatric, herbal, Tulsi

INTRODUCTION:



fig. 1chocolate

Chocolate (see Fig. 1) is one of the most popular foods among children, while medicine is often disliked. This study aims to create a “medicated chocolate,” combining chocolate with a medicinal ingredient to aid in disease prevention. Common ailments in children include coughs and viral infections. *Ocimum sanctum*, or Tulsi, is a herb known for its medicinal properties, including antitussive (cough-relieving) effects. This project focuses on formulating a chocolate infused with Tulsi extract to provide antitussive benefits.

The medicated chocolate is evaluated for attributes such as appearance, dimensions, hardness, bloom stability (to test texture and color), drug content, and physical stability. Chocolate is a versatile food, able to pair with many ingredients to create unique tastes and textures. Being an anhydrous medium, it inhibits microbial growth and helps protect water-sensitive active ingredients. Additionally, chocolate contains compounds like saturated fats, polyphenols, sterols, di- and triterpenes, aliphatic alcohols, and methylxanthines. It also has phenylethylamine, often called “the love drug,” which naturally occurs in the brain and is linked to feelings of happiness. In chocolate, phenylethylamine can elevate blood pressure and blood sugar, contributing to a sense of well-being.

Humans recognize five basic tastes: sweet, sour, bitter, salty, and savory. Sweetness is especially pleasurable, helping us identify high-calorie foods. In this study, the medicated chocolate is prepared by creating a chocolate base, into which the Tulsi extract is incorporated. This approach aims to make medicine more enjoyable for children by combining therapeutic benefits with the enjoyable taste of chocolate.

When chocolate is used as a vehicle to deliver medication, it enables the controlled release of drugs directly from the chocolate matrix, creating what is known as a “chocolate drug delivery system.” This method is especially effective for children, combining a familiar and enjoyable food with medicinal benefits, making it a highly suitable drug delivery method for pediatric patients. The primary goal of this study is to develop a Pediatric Herbal Chocolate containing an extract of *Ocimum sanctum* (Tulsi), a herb known for its medicinal qualities, including its antitussive (cough-suppressing) properties. Given that coughs and viral infections are common ailments among children, the therapeutic profile of Tulsi makes it an ideal choice for formulating a medicated chocolate aimed at health prevention.

The prepared chocolate formulation undergoes evaluations based on multiple physical and chemical parameters, such as appearance, dimensions, hardness, bloom stability, drug concentration, and physical stability, to ensure its quality. The oral route is typically favored for ease of patient use, though it does present challenges, particularly for drugs susceptible to first-pass metabolism. In such cases, alternative routes like the trans-mucosal method, which uses mucosal linings of areas such as the nasal, vaginal, rectal, and oral cavities, are employed to avoid early degradation in the digestive tract.

Chocolate’s properties make it an ideal carrier for drug delivery: its anhydrous nature resists microbial growth and protects water-sensitive drugs from hydrolysis. Additionally, chocolate’s sensory qualities, such as its smooth, creamy texture, are effective at masking unpleasant flavors and eliminating the gritty feel associated with certain active agents. Created by blending cocoa with cocoa butter and sugar, chocolate not only provides an enjoyable taste but also offers potential for bypassing first-pass metabolism. This study therefore focuses on formulating and evaluating Tulsi-infused medicated chocolate as a novel, child-friendly drug delivery system, emphasizing its therapeutic effects, stability, and suitability for commercial use.

Chocolate acts as an anhydrous medium, which helps prevent microbial growth and protects water-sensitive active ingredients from hydrolysis. These properties make chocolate an excellent vehicle for delivering medicinal compounds. Its versatility allows it to be customized to create various taste and texture profiles, making it a sophisticated option for food formulations. Additionally, chocolate’s sensory qualities effectively mask unpleasant tastes of certain active ingredients, providing a smooth, creamy consistency that helps eliminate any gritty texture (Lang, 2007).

Among the many healthy substances found in chocolate include sterols, polyphenols, saturated fats, aliphatic alcohols, methylxanthines, di- and triterpenes, and polyphenols (Knight, 2000). Cocoa, the main component of chocolate, is particularly rich in polyphenols, especially flavan-3-ols like epicatechins, catechins, and procyanidins (Lamuela-Raventos et al., 2001; Hammerstone et al., 2000; Scalbert et al., 2000; Adamson et al., 1999; Lazarus et al., 1999). Research suggests that diets high in flavonoids, a type of polyphenol, may lower the risk of coronary heart disease, potentially due to their antioxidant effects (Geleijnse et al., 1999; Hertog et al., 1995; Fuhrman et al., 2001).

Taste refers to the sensation of flavor that occurs when a substance contacts the mouth. Foods or medications are considered “palatable” when they are pleasant to taste (Oxford Dictionary, 2007). The main cells responsible for taste are modified epithelial cells, which are grouped into taste buds located on the tongue’s taste papillae (Llorens et al., 2004). The four main categories of taste are sour, bitter, salty, and sweet.

Children's taste perceptions differ notably from adults'. Studies indicate that infants and young children have a preference for sweet flavors, which gradually shifts to align more closely with adult taste preferences as they reach adolescence (Mennella et al., 2005; Lawless et al., 1985; Liem et al., 2002). However, children also show a natural aversion to bitterness from an early age, which can make bitter-tasting foods or medicines less appealing. This strong aversion has even led to the inclusion of bitter agents as a safety measure to prevent accidental consumption of potentially toxic substances.

THE BENEFITS OF TULSI, MINT, AND FINGER MILLET FOR CHILDREN:

1. Tulsi (Holy Basil)



fig.2health benefits of tulsi

1. Skin Protection: Adding Tulsi to bath water or applying its leaves on the skin can guard against infections, mosquito bites, and insect stings.
2. Immune Boosting: Drinking Tulsi-infused water daily can naturally strengthen children's immune systems.
3. Oral Health Support: Tulsi helps reduce oral bacteria, which lowers the risk of plaque, bad breath, and cavities.
4. Digestive Aid: Tulsi promotes healthy digestion by stimulating digestive enzymes and acting as a mild appetite enhancer.
5. High in Vitamin K: It's a great source of vitamin K, crucial for bone strength, heart health, brain function, and metabolism.
6. Respiratory Relief: Tulsi can help alleviate respiratory problems, such as bronchitis and other breathing issues.



fig.3 nutritional components of tulsi

2.Mint (Pudina)

1. Supports Digestion: Mint's carminative properties make it helpful in soothing the digestive system and relieving stomach aches.
2. Nutrient-Dense: Mint is rich in vitamins A, C, B-complex, as well as iron, potassium, and manganese, which aid in brain function, immunity, and blood health.
3. Natural Cooling Effect: It acts as a coolant, helping balance body temperature, especially in warm weather.
4. Antioxidant-Rich: Mint's essential oils contain antioxidants that protect cells against free radicals.
5. Culinary Versatility: Mint adds a refreshing taste to various dishes like teas, drinks, chutneys, and salads, enhancing both flavor and nutrition.

Health Benefits of Mint in your Child's Diet

- ✦ Fights Allergies
- ✦ Improves Skin
- ✦ Curing Common Cold
- ✦ Improves Oral Health
- ✦ Gives Relief from Pain
- ✦ Improves Bowel Movement
- ✦ Gives relief from Indigestion



fig. 4health benefit of pudina

3.Finger Millet (Ragi)



fig.5 finger millets flour

1. Nutrient-Rich: Finger millet provides essential minerals like calcium, iron, magnesium, phosphorus, and potassium, which support growth and development.
2. Long-Lasting Energy: The complex carbs in ragi supply steady energy, ideal for active kids.

3. Protein Source: Ragi contains protein, which aids muscle growth and immune function.
4. Gluten-Free Grain: It's a safe option for children with gluten sensitivity or celiac disease.
5. Supports Digestive Health: Ragi's fiber content helps with digestion and prevents constipation.
6. Promotes Cognitive Health: The antioxidants, folate, and vitamin E in ragi are beneficial for brain health and mental development.



fig.6 nutritional benefits of finger millets flour

Incorporating Tulsi, Mint, and Finger Millet into children's diets provides a natural way to support overall health and growth.

AIM AND OBJECTIVE :

The primary goal of this invention is to develop an innovative herbal chocolate specifically aimed at treating viral infections in children. Recognizing that chocolate is a beloved treat among kids while traditional medicines are often disliked, this study seeks to create a medicated chocolate that incorporates therapeutic elements.

The formulation features *Ocimum sanctum* (Tulsi), a herb recognized for its numerous medicinal benefits, particularly its antitussive (cough-relieving) properties. By using an aqueous extract of Tulsi, this chocolate offers a more appealing and enjoyable method for addressing viral infections in pediatric patients.

The key objectives include:

1. Developing a chocolate product that incorporates herbal ingredients beneficial to children's health.
2. Ensuring that the chocolate is safe, appealing, and easy for children to digest.
3. Conducting research to validate the effectiveness and safety of the herbal components included in the formulation.
4. Collaborating with pediatric healthcare professionals to incorporate the product into care plans for children.
5. Providing educational resources for parents about the product's benefits and appropriate usage.
6. Continuously assessing and enhancing the product based on user feedback and advancements in scientific knowledge.

LITERATURE REVIEW

1. Mahendra Dwivedi et al. (2023)

This research aimed to create and evaluate a polyherbal medicated chocolate specifically designed for deworming the stomach and related issues, with an emphasis on enhancing bioavailability and patient adherence compared to traditional treatments. The formulation was prepared using a direct melting method, in which herbal components were blended into a chocolate base. Various characteristics were assessed, including shape, taste, texture, moisture content, and stability. The results showed favorable outcomes in physical assessments and met the necessary drug delivery criteria, indicating potential therapeutic effectiveness. The study concluded that this cost-effective medicated chocolate could significantly improve drug

compliance and bioavailability. Keywords: medicated chocolate, deworming, herbal, modified dosage form, gastrointestinal problems, and herbal fruits and spices.

2. Sharma Mayank & Jain Dinesh Kumar (2012)

This study aimed to develop a tasty chocolate formulation containing Domperidone and Cetirizine intended for pediatric patients, thus enhancing the likelihood of children consuming their medication. The chocolate base was created using cocoa powder, cocoa butter, lecithin, and pharmaceutical-grade sugar, followed by the integration of the drugs. The evaluation included assessments of appearance, moisture content using a digital Karl Fischer titrator, a blooming test, drug content analysis, and the compatibility of drug-excipient combinations.

3. David L. Kartz & Ather Ali (2011)

The findings of this study highlighted the extensive health benefits of cocoa, largely due to its rich content of phenolic antioxidants, particularly flavonoids such as catechin, epicatechin, and procyanidins. These antioxidants can neutralize reactive oxygen species, promote the production of nitric oxide, and provide anti-inflammatory effects, potentially decreasing the risk of diabetes. Additionally, cocoa consumption has been linked to protective benefits for nerve and skin health, enhanced feelings of fullness, improved cognitive function, and mood elevation. However, overindulgence, particularly in high-calorie chocolate forms, may lead to weight gain. In summary, moderate consumption of cocoa or dark chocolate appears to yield health benefits.

4. Pallavi D. Pawar & Akshada Bakliwal (2019)

This study's main objective was to develop a nutritious chocolate formulation containing natural nervine tonics to enhance memory and learning without causing adverse effects. The formulation included Shatavari and Bacopa monnieri to improve patient compliance and therapeutic efficacy. Quantitative analysis of shatavarin and bacoside A was performed using HPTLC methods. Various parameters were evaluated, including sensory properties, pH, blooming tests, preliminary phytochemical screening, microbial contamination, and stability tests to ensure the safety and quality of the chocolate formulation.

5. Firoj A. Tamboli et al. (2021)

Inspired by children's preference for chocolate over traditional medication, this study developed a medicated chocolate infused with *Ocimum sanctum* (Tulsi) extract, known for its cough-relieving properties, to address common respiratory conditions such as coughs and viral infections. The goal was to create a palatable and effective way to administer herbal medicine to children. The medicated chocolate was evaluated on various criteria, including overall appearance, dimensions, hardness, results from the blooming test, drug content analysis, and physical stability to ensure both efficacy and acceptability.

PLANT PROFILE:

Table 1 Tulsi

Botanical Name	<i>Ocimum tenuiflorum</i>
Synonyms	<i>Ocimum sanctum</i> , Holy Basil
Common Name	Tulsi
Family	Lamiaceae
Order	Lamiales
Kingdom	Plantae
Genus	<i>Ocimum</i>
Division	Magnoliophyta

Active Phytochemicals	Oleanolic acid, Ursolic acid, Rosmarinic acid, Eugenol, Carvacrol, Linalool
Research Part Used	Leaves
General Uses	Tulsi is commonly utilized to relieve insect bites and is effective in managing heart diseases and fever. It also helps treat respiratory conditions. Additionally, Tulsi is beneficial for alleviating fever, the common cold, sore throat, headaches, and kidney stones.

Table 2 Mentha

Plant	Mentha
Botanical Name	Mentha
Synonyms	Lamiaceae Mint, Genus Mentha, Mint Family
Common Name	Pudina
Family	Lamiaceae
Order	Lamiales
Kingdom	Plantae
Genus	Mentha
Division	Magnoliophyta
Active Phytochemicals	Menthol, Menthone, Limonene, Methyl acetate, Beta pinene, Beta caryophyllene
Parts Used for Research	Leaves
General Uses	Mentha species are among the oldest and most popular herbs worldwide, utilized extensively in various medicinal and culinary applications.

PHARMACOLOGICAL ACTIVITY:

Pharmacological Activity of Tulsi

Viral infections remain a significant global threat to both human and animal health, particularly in India. The infectious nature of viral pathogens, their ability to evade host defenses, and the lack of affordable antiviral treatments complicate the management of viral diseases in both human and veterinary medicine. While the search for new antiviral drugs is ongoing, natural compounds from plant sources offer a promising opportunity for developing effective antiviral therapies. Extensive research is currently focused on identifying new bioactive compounds from diverse sources, including fungi, marine organisms, bacteria, and plants. A key strategy to enhance the likelihood of finding therapeutically useful molecules is to examine the ethnopharmacological knowledge derived from traditional healing systems, such as Ayurveda. However, medicinal plants referenced in Ayurvedic texts need to be validated through modern in vitro assays. Viruses, unlike other pathogens, are obligate intracellular parasites, making their treatment more complex.

Pharmacological Activity of Pudina

Mentha longifolia (wild mint) is well-known as a traditional folk remedy. Different parts of this plant have been used in traditional medicine throughout Iran and other countries. A variety of studies have highlighted its numerous pharmacological and therapeutic effects. This review aims to summarize the traditional uses of *M. longifolia* alongside the pharmacological and therapeutic impacts of its extracts and key constituents. This herb possesses a wide range of pharmacological properties, including antimicrobial, gastrointestinal, and effects on the nervous system. Pulegone is the main compound linked to many of its pharmacological activities, followed by menthone, isomenthone, menthol, 1,8-cineole, borneol, and piperitenone. Furthermore, the plant can exhibit dose-dependent toxic effects in different bodily systems. Based on a comprehensive review of existing literature, *M. longifolia* presents a promising natural resource for the development of new medications. However, additional studies are necessary to establish the plant's quality and safety for clinical application

MATERIAL EQUIPMENT

Table 3 Ingredient

Item	Description
Chocolate base	Freshly prepared chocolate base
Sugar	Refined sugar
Tulsi extract	Natural herbal extract
Pudina extract	Natural herbal extract
Finger millet flour	Nutraceutical flour

Table 4 Equipment

Equipment Name
Weighing balance
Water bath
Mortar and pestle
Beaker
Stirrer
Various glassware

Table 5 Formulation Table

Component	Amount
Chocolate base	5 grams
Sugar	2 grams
Tulsi extract	250 milligrams
Pudina extract	250 milligrams
Finger millet flour	2.5 grams
Water	Q.S. (Quantity Sufficient)

METHODS

Extraction of Tulsi

1. Collection and Cleaning: Fresh Tulsi leaves were gathered from a home garden and thoroughly washed to remove any dirt.
2. Crushing: The cleaned leaves were ground into a paste using distilled water and a grinding machine.
3. Decoction: The resulting paste was boiled in distilled water for 30-45 minutes using the decoction method, taking care not to overheat the mixture.
4. Filtration and Concentration: The extract was filtered, and the water was evaporated using an electric water bath to obtain a crude extract.
5. Phytochemical Analysis: Phytochemical tests were conducted on the aqueous extract of Tulsi to identify its constituents.

Extraction of Mint Leaves

1. Preparation: Mint leaves were thoroughly washed to remove any impurities and then gently dried using a clean cloth or paper towel.
2. Crushing: The dried mint leaves were placed in a clean mortar and pestle, or bruised by hand to break open the cell walls and release the essential oils.
3. Compression: The crushed leaves were transferred to an airtight container, where they were pressed down evenly with a spoon or small roller to extract the oils.
4. Infusion Period: The compressed leaves were allowed to sit in the container for at least 24 hours, enabling the essential oils to seep out and collect at the bottom.
5. Straining: After 24 hours, the liquid was strained through a fine mesh sieve or cheesecloth to separate the extracted oil from the leaves, with the option to repeat the process for a more concentrated extract.
6. Storage: The extracted mint oil was placed in a clean, airtight bottle and stored in a cool, dark area away from direct sunlight to maintain its efficacy.

Method of Preparation

1. Measuring Ingredients: All ingredients were carefully weighed.
2. Melting the Chocolate Base: A water bath was heated to approximately 50°C, and the chocolate base was melted in a porcelain dish until it was free-flowing.
3. Making Sugar Syrup: Sugar syrup was prepared by dissolving sugar in the appropriate amount of distilled water in a beaker placed in the water bath.
4. Combining Ingredients: The prepared sugar syrup was added to the melted chocolate base in the required quantity.
5. Adding Herbal Extracts: The crude extracts of Tulsi and Pudina were incorporated into the mixture, which was stirred continuously.

- 6. Setting the Chocolate: The final mixture containing the herbal extracts was poured into molds and placed in the freezer to set overnight.



Fig. 7: Herbal Ingredients

Material and Equipment



Fig.8 Filtration



Fig. 9 Melting of sugar



Fig.10 Melting of Chocolate base



Fig.11 Chocolate



Fig.12 Prepared Formulation of Herbal Chocolate

Evaluation parameters

1. Test Observations

Sr. No.	Item	Description
1	5 % Ferric Chloride Solution	Deep blue-black coloration
2	Lead Acetate Solution	Formation of precipitate
3	Bromine Water	Decolorization of bromine water
4	Dilute Iodine Solution	Temporary red coloration

2.General Appearance

Color: Dark brown

Odor: Pleasant, with no burnt scent

Taste: Mildly sweet

Texture: Smooth and uniform

3.Physical Stability

Method: A sample of the chocolate is stored in a sealed container at 28°C for one month.

Evaluation: After a month, the sample is examined for any changes in appearance and signs of drug degradation.

4.Drug Content Analysis

Technique: Thin Layer Chromatography (TLC)

Control Sample: Aqueous Tulsi extract

Test Sample: Melted chocolate mixture

Procedure:

TLC plates are prepared with silica G and activated for 30 minutes.

Spotting is done with capillaries on both the control and test plates.

The mobile phase used is a mixture of Toluene, Ethyl acetate, and Water in a 7:3:2 ratio.

After development, the plates are air-dried and viewed in an iodine chamber.

Drug Content Calculation: By comparing the RF values of the control and test samples.

5.Dimensions

Measurement: Dimensions of the chocolate are measured using a Vernier caliper for precision.

6.Moisture Content Analysis

Method:

The chocolate mixture is weighed precisely, then placed in a desiccator containing anhydrous silica gel for 24 hours.

Formula:

$$\text{Moisture Content (\%)} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Final weight}}$$

7.Viscosity Measurement of Chocolate Base

Equipment: Brookfield Viscometer

Procedure: The chocolate base is heated to 50°C, and the viscometer spindle rotates at 20 rpm to measure viscosity.

This outline provides a structured approach to assess the herbal chocolate formulation's physical stability, drug content, dimensions, moisture content, and viscosity.

Result and Conclusion:

This study focused on creating a Pediatric Herbal Chocolate with antitussive (cough-relieving) properties. Tulsi leaf extract was prepared in an aqueous form, and phytochemical tests confirmed the presence of the targeted compounds, yielding satisfactory results. Using this extract, a medicated chocolate formulation was developed and tested across multiple parameters, including appearance, dimensions, hardness, blooming tendency, drug content, and physical stability.

The study results demonstrate that the chocolate formulation provides a smooth and creamy texture, effectively masking any bitterness associated with certain medications. This chocolate-based system holds potential as a practical and effective oral drug delivery method, particularly suitable for pediatric patients.

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