CODEN [USA]: IAJPBB ISSN : 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

SJIF Impact Factor: 7.187

https://doi.org/10.5281/zenodo.17306022

Available online at: http://www.iajps.com Research Article

FORMULATION AND EVALUTION ANTIPYRETIC HERBAL CHOCOLATES FOR PEDIATRIC PURPOSE BY USING DIFFERENT PLANTS EXTRACTS.

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Abstract:

Fever is one of the most frequent causes of medical consultations globally and one of the earliest clinical signs of illness in the mammalian host. One of the most common medications used to treat fevers is an antipyretic. Oral administration is among the safest ways to ensure patient compliance. Chocolate is a very complex and versatile food that may be combined to create entirely different flavors and textures. We have created a chocolate medication delivery method since chocolate is especially delicious and well-liked by children. Chocolate also has advantages, such as a rapid beginning of action, a smaller dosage of the medication, ease of production and scaling, a higher drug loading capacity, etc. A semisolid media suspended with approximately 70% fine solid sugar, cocoa, and/or milk particles makes up chocolates, which are continuous fat phases. Since ancient times, physicians in the Indian medical system have used Tamarindus indicus, Cucurbita pepo, Zingiber officinale, Mentha piperita, and Malus domestica extensively, both on their own and in combination with other drugs. The current study's goal was to create safe and palatable antipyretic chocolate. Additionally, to assess the created formulations' physiochemical properties in order to further standardize and commercialize them.

Keywords: *Malus domestica,physiochemical,Tamarindus indicus,Chocolate,Antipyretic,pediatrics.*

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Please cite this article in press Manish Ahire et al., ***Formulation And Evalution Antipyretic Herbal Chocolates For Pediatric Purpose By Using Different Plants Extracts****, Indo Am. J. P. Sci, 2025; 12(10).*

INTRODUCTION:

Since ancient times, fever has been a common symptom of illness. Fever is one of the most frequent causes of medical consultations globally and one of the earliest clinical signs of illness in the mammalian host. Fever frequently results from trauma, inflammation, and infection. Numerous infectious and non-infectious factors can raise the hypothalamic thermoregulatory setpoint, which results in fever or pyrexia. This perspective on fever, however, is simply oversimplified because an increasing amount of data currently indicates that fever is a complicated adaptive response of the host to a variety of immunological challenges, whether they are infectious or not.

In times of stress or infection, an increase in body temperature provides a number of physiological benefits, potentially as a result of modifications to the host immune system. Elevated body temperature is not the same as fever, even though it is an essential part of the febrile reaction. Fever is commonly defined as a controlled increase in body temperature above typical daily variations that coincides with a higher thermoregulatory set point.

Fig no 1 : Fever

The above-described humoral and neural fever signals cause the thermal balance point to be reset to a higher level, starting a feedback loop that results in a series of behavioral and clinical symptoms that define the feverish response. Heat loss is prevented by skin vasoconstriction (which causes goosebumps and chills) and behavioral strategies including reducing body surface area by assuming a fetal position, wearing thick clothing, and seeking out warmer surroundings in order to reach the new balancing point [1].

Then, a number of heat-gain mechanisms are triggered, such as increased muscle contraction, which results in rigors. Sweating and other heat loss mechanisms are activated when the fever signal in the central nervous system is eliminated, causing the equilibrium point to return to normal. Fever is therefore frequently characterized by chills, rigors, and an increase in body temperature, followed by perspiration and a subsequent drop in body temperature.

One of the most commonly used medications in medicine is an antipyretic. There are many pharmaceutical methods for lowering body temperature, including acetaminophen, salicylates, non-steroidal anti-inflammatory drugs (NSAIDs), and selective cyclooxygenase 2 (COX-2) inhibitors. Nonpharmacological methods include cooling blankets and tepid sponges. Physical therapy and medications such cyclooxygenase 2 (COX-2) inhibitors, paracetamol, and nonsteroidal anti-inflammatory medicines (NSAIDs)[2].

Common methods for lowering a feverish person's body temperature include cooling blankets and immersion. Antipyretics can potentially cause hepatic and renal failure and have significant hemodynamic side effects. Certain patients may not be able to use the available antipyretics due to their selective toxicity. There is little information available on the use of antipyretics to regulate body temperature in noncritical patients[3].

The therapeutic end points must be taken into account before discussing the use of antipyretics in children who are feverish. Instead than stressing normothermia, doctors should focus on the child's comfort and indications of a serious illness when advising families. Improving the child's general comfort should be a top priority when treating a feverish child. Along with reduced oral intake, the majority of pediatricians note that children who are feverish also exhibit changes in activity, sleep, and behavior, with little evidence to support this observation.

In order to lower fever in pediatric patients, doctors prescribe a variety of medications, such as Pagdol P suspension, Kritsaps syrups, Meftal P suspension, etc., but frequently, crying children throw up the medication, which prevents us from getting the desired results. To avoid this, we use herbal chocolate. In this formulation, we have added plant extracts that have antipyretic properties and lower fever [4].

Oral administration is among the safest ways to ensure patient compliance. Chocolate is a very complex and versatile food that may be combined to create entirely different flavors and textures. We have created a chocolate medication delivery method since chocolate is especially delicious and well-liked by children. Chocolate also has advantages, such as a rapid beginning of action, a smaller dosage of the medication, ease of production and scaling, a higher drug loading capacity, etc. A semisolid media suspended with approximately 70% fine solid sugar, cocoa, and/or milk particles makes up chocolates, which are continuous fat phases [5]

Fig no 2 :Herbal chocolate

Because chocolate is an anhydrous media, it is also impervious to the growth of microorganisms and the deterioration of water-sensitive active components. It makes a lot of sense to use chocolate as a vehicle for active ingredients. The organoleptic qualities of chocolate, for example, are excellent for reducing unpleasant flavors associated with specific active chemicals and providing a smooth and creamy texture to otherwise unsightly granular active component compositions. A chocolate base is used to create medicated chocolate, and once the base is prepared, the medication is added.

Because the medication is integrated into the chocolate and released from it, it is known as a "chocolate drug delivery system"1. The health benefits of chocolate are mostly due to the antioxidant properties of the flavonoids in cocoa.

Tamarindus indicus has been widely used by physicians in the Indian medical system since the beginning of time, both by itself and in combination with other drugs. It belongs to the Fabaceae family and is commonly called Chincha. It is considered a rasayana in Ayurveda and is used to chill the body. It has been praised for its capacity to both stimulate and calm the body at the same time. The pumpkin, or *Cucurbita pepo*, is also good for lowering fever [5] .The antibacterial and antiviral properties of *Zingiber officinale*, or ginger, help to eradicate infections and the symptoms of numerous illnesses, including influenza, colds, and fevers. Mint (*Mentha piperita*) is also good for reducing fever and increasing sweat. Additionally, the apple (*Malus domestica*) lowers fever. Vanilla is primarily used as a flavoring, but it can also help lower fevers [6]

The current study's goal was to create palatable and healthful antipyretic chocolate. Additionally, to assess the created formulations' physiochemical properties in order to further standardize and commercialize them. According to a survey, the Indian chocolate market, which was valued at $1,687.23 million in 2022, is projected to increase at a Compound Annual Growth Rate of more than 6.69 percent to reach $2,457.48 million by 2028.

MATERIALS AND METHODS:

Materials :

Tamarindus indicus, *Cucurbita pepo*, *Zingiber officinale*, *Mentha piperita*, *Malus domestica*, and vanilla as the chocolate base were all precisely weighed. It was gathered from Takli Dhokeshvar, Parner, and Aahilyanagar's local stores and farms.

Procedure 1

Dark chocolate compound was taken in a beaker and melted

Tamarindus indicus, Cucurbita pepo, Zingiber officinale, Mentha piperita, and Malus domestica were precisely measured and mixed in another beaker

Prepared powders were added into the melted chocolate

Vanilla and almonds were incorporated as flavouring agents

The final chocolate mixture was poured into moulds and kept in the freezer overnight to set

Procedure 2

Water bath was prepared and maintained at ~50 °C

Chocolate base was melted in a porcelain dish until free-flowing

Sugar syrup was prepared separately by dissolving sugar in distilled water on water bath

Prepared sugar syrup was poured into the melted chocolate base

Crude extracts of Tamarindus indicus, Cucurbita pepo, Zingiber officinale, Mentha piperita, and Malus domestica were added with constant mixing

Final chocolate mass was poured into silicon moulds and refrigerated for 3–6 hours until solidified

Table no 1 :Formula of herbal chocolate

Sr.No	Content	F1	F2	F3	Role
1.	Chocolate compound	2.50 gm	5.911 gm	4.80 gm	Chocolate base
2.	*Tamarindus indicus*	1.96 gm	0.921 gm	0.921 gm	Treat fever
3.	*Cucurbita pepo*	1.96 gm	0.921 gm	0.921 gm	Reduce body temperature
4.	*Zingiber officinale*	2.80 gm	1.654 gm	2.40 gm	Reduce body temperature
5.	*Mentha*	0.50 gm	0.291 gm	0.45 gm	Treat fever
	piperita				
6.	*Malus domestica*	1.60 gm	0.280 gm	0.45 gm	Maintain body cool
7.	Vanilla	Q.S	Q.S	Q.S	Treat fever and used as flavour.

Profile of ingredients

***1. Tamarindus indicus*[23]**

The edible fruit-bearing leguminous tree known as the tamarind (*Tamarindus indica*) is native to tropical Africa and has spread to Asia. Tamarindus is a monotypic genus, which means that it only includes this species. It is a member of the Fabaceae family.

The brown, pod-like fruits of the tamarind tree are utilized in many different cuisines all over the world because of their sweet, acidic pulp. Additionally, the pulp is utilized as a metal polish and in traditional medicine. Tamarind seed oil can be produced from the seeds, and the wood of the tree can be utilized for carpentry.

Role : For treating fever and cooling sensation .

Fig no 3 :*Tamarindus indicus*

2.*Cucurbita pepo* [24]

One of the genus Cucurbita's cultivated plants is *Cucurbita pepo*. Although it produces winter squash and pumpkin variants, the most common types are from the subspecies *Cucurbita pepo* subsp. pepo, also known as summer squash. For thousands of years, people in the Americas have tamed it. Some

authors argue that *C. pepo* is descended from *C. texana*, while others suggest that *C. texana* is merely feral *C. pepo*. They can be used for many different things, namely as food and to treat illnesses. Although there are differences over the precise extent of that relationship, *C. pepo* appears to be more closely linked to C. fraterna.

Fig no 4 :*Cucurbita pepo*

3.*Zingiber officinale* [25]

The flowering plant ginger (*Zingiber officinale*) is used extensively as a spice and a folk remedy for its rhizome, sometimes known as ginger root. This perennial herbaceous plant produces annual pseudostems, which are artificial stems composed of the coiled bases of leaves, that are around one meter tall and have narrow leaf blades. The inflorescences grow directly from the rhizome on distinct branches and contain blooms with pale yellow petals and purple borders.

Ginger belongs to the Zingiberaceae family, which also contains galangal, cardamom (*Elettaria cardamomum*), and turmeric (*Curcuma longa*). The Austronesian peoples most likely domesticated ginger earliest, and it originated in Maritime Southeast Asia.

Fig no 5:*Zingiber officinale*

4.*Mentha piperita* [26]

A combination of spearmint and watermint, peppermint (*Mentha × piperita)* is a type of mint. The plant, which is native to Europe and the Middle East, is now grown and dispersed throughout much of the world. Sometimes, it can be found in the wild with its parent species. Although there are around 25 species in the genus Mentha, peppermint is the one that is most frequently used.

Chinese peppermint, also known as bohe, is made from the fresh leaves of *M. haplocalyx*, whereas Western peppermint is made from M. × piperita. Among the earliest herbs used in both culinary and medicinal goods, *M. × piperita* and *M. haplocalyx* are known to be plant sources of menthol and menthone.

Fig no 6 :*Mentha piperita*

5.*Malus domestica* [27]

Within the family Rosaceae, the genus Malus contains roughly 32–57 species[4] of tiny, deciduous trees or shrubs, such as the cultivated orchard apple, crab apples (sometimes called crabapples in North America), and wild apples. When fully grown, apple trees often stand 4–12 meters (13–39 feet) tall with a dense, twiggy canopy. The leaves are simple, alternating, 3–10 cm (1+1⁄4–4 inches) long, and have a serrated edge.

Fig no 7 :*Malus domestica*

6.Vanilla [28]

The flat-leaved vanilla (*V. planifolia*) pods are the main source of vanilla, a spice made from orchids in the genus Vanilla. Since vanilla is not autogamous, pollination is necessary for the plants to provide the fruit that is used to make the spice. This fact was discovered in 1837 by Belgian botanist Charles François Antoine Morren, who also developed a technique for artificially pollination the plant. The approach was not used commercially since it was financially unfeasible. Currently, three main varieties of vanilla are farmed around the world; they are all descended from a variety that was first discovered in Mesoamerica, which includes areas of present-day Mexico. They are *V. × tahitensis*, which is grown in the South Pacific; *V. planifolia* (syn. *V. fragrans*), which is grown in Madagascar, Réunion, and other tropical regions along the Indian Ocean;

and *V. pompona*, which is found in the West Indies, Central America, and South America.

Fig no 8 :Vanilla

Evaluation parameters :

1. Phytochemical analysis

2. General appearance

3. Hardness [7]

Hardness of chocolate was measured by Monsanto Hardness Tester.

4. Blooming test [8]

Fat Bloom - when a thin coating of fat crystals forms on the chocolate's surface. As a result, the chocolate will become less glossy and develop a delicate white coating, making the final product appear unappetizing.
The migration of a filling fat to the chocolate layer or the recrystallization of fat are the two main causes of fat bloom. Maintaining a steady temperature during storage will postpone the onset of fat bloom.

Fig no 9: Blooming test of herbal chocolate

5. Physical stability [9]**:**

A sample of chocolate was stored in a closed container at 28°C for a month in order to assess its physical stability. A month later, the chocolate test sample was examined for both drug degradation and physical appearance.

6. Drug content determination [9]

The drug content of medicated chocolate was assessed using Thin Layer Chromatography. In this instance, the control sample was watery, and the test sample was melted chocolate. The TLC plates were prepared using silica G and activated for ½ hour. Both the control and test plates were spotted using capillaries. Run both plates in the toluene, ethyl acetate, and water (7:3:2) mobile phase. Both plates were operated on and then allowed to air dry in an iodine chamber. By comparing the RF values of the test and control plates, the medication content of medicated chocolate was determined.

RESULT AND DISCUSSION:

Phytochemical screening

Table no 2 : Phytochemical screening of extracts of herbal chocolate.

Sr.No	Test	Observation
1.	5%Fecl3 solution	Deep brown black colour
2.	Lead acetate solution	Precipitate formation
3.	Bromine water	Decolouration of bromine water
4.	Dilute iodine solution	Transient red colour

General appearance

Color - Dark Brown

Oduor - Chocolate with no brunt, no smoky smell

Taste - Slight sweet

Texture - Smooth and even Dimension It was measured by Vernier's calipers.
Batch I - Height: 8.88 ±0.15

Diameter: 35.07 ±0.05

Batch II -Height: 8.50 ±0.050

Diameter: 31.50 ±0.030

Batch III -Height: 8.87±0.19
Diameter: 30.80 ±0.045

Hardness

Table no 3 : Hardness of herbal chocolate

Formulation code	F1	F2	F3
Hardness (Kg/cm2)	3.3	3.2	2.9

Blooming test

Table no :Blooming test of herbal chocolate

Test	Batch 1	Batch 2	Batch 3
Fat bloom	No	No	No
Sugar bloom	No	No	No

Physical appearance

Colour - Dark Brown

Odour - Chocolate with no brunt, no smoky smell

Taste - Slight sweet

Texture - Smooth and even

Future Scope

1. Novel Drug Delivery System for Children

   Herbal chocolate can serve as a child-friendly alternative to conventional syrups or tablets. Since many young children dislike the taste of bitter herbal formulations or standard medicines, incorporating herbal extracts into chocolates may improve palatability and compliance, thereby enhancing therapeutic outcomes.

2. Integration into AYUSH and Functional Foods

   With the rising global interest in Ayurveda and functional foods, herbal chocolates hold potential as nutraceutical products. They can act as a bridge between food and medicine, offering both health benefits and consumer acceptance. Such formulations may particularly find relevance in integrative pediatric healthcare under AYUSH-based practices.

3. Clinical Trials and Evidence-Based Applications

Future research can focus on clinical trials to establish the safety, efficacy, and tolerability of herbal chocolates in children. These studies would help in validating their antipyretic and therapeutic potential compared to conventional drugs. Strong evidence from such trials could support the incorporation of herbal chocolates into evidence-based medical practice, enhancing their credibility and acceptance.

CONCLUSION:

A possible method of providing medicinal herbs in a tasty and kid-friendly form is the creation and testing of herbal chocolate for antipyretic efficacy in pediatric patients. Traditional antipyretic herbs like *Tamarindus indicus*, *Cucurbita pepo*, *Zingiber officinale, Mentha piperita, Mallus domestica*, and Vanilla have been demonstrated to have the ability to reduce mild fevers and alleviate symptoms in children when added to chocolate bases.

Based on initial assessments, herbal chocolate is well-liked by young patients since it tastes good and is simple to use. Basic stability tests, organoleptic traits, and physicochemical qualities have all produced positive findings, indicating that these formulations may be useful and efficient.

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