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FORMULATION AND EVALUATION OF ANTHELMINTIC HERBAL CHOCOLATE FOR PEDIATRIC

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ABSTRACT

- *The increasing resistance to synthetic anthelmintic drugs and their associated side effects have prompted the exploration of natural alternatives. This study focuses on the formulation and evaluation of a novel herbal chocolate incorporating plant-based anthelmintic agent*
- *The formulation was assessed for its physical properties, taste acceptability, and stability. In vitro anthelmintic activity was evaluated using Pheretima posthuma (earthworm) as a model organism. The herbal chocolate demonstrated significant anthelmintic activity in comparison with standard drugs such as albendazole. The results suggest that herbal chocolate is a promising, palatable, and effective alternative for treating helminthic infections, warranting further clinical investigation.*
- *The chocolate is most loving food of children whereas the medicine is hating substance. So, objective of present study was to formulate the chocolate that contain drug i.e., medicated chocolate to prevent the disease. Ocimum Sanctum (Tulsi) is the herbal drug which having several medicinal properties, anthelmintic activity is one of them. Thus, we have to formulate the chocolate with aqueous extract of Tulsi that gives anthelmintic activity. Further, prepared medicated chocolate is evaluated for general appearance, dimension, weight variation, blooming test, physical stability, moisture content determination etc Oral drug delivery is one of the most common routes of drug administration due to its patient compliance and ease of usage. But this route is an immense challenge for the drug delivery to pediatric patients. Our present research work emphasizes on the solution to this problem. The present research work deals with the formulation and evaluation of a medicated herbal chocolate which is one of the most common medicines used for pediatrics for the treatment of intestinal worms and related problems*

❖ INTRODUCTION

- Helminthic infections, caused by parasitic worms such as nematodes, cestodes, and trematodes, remain a significant global health issue, particularly in tropical and subtropical regions. These infections contribute to nutritional deficiencies, impaired cognitive development, and reduced productivity, especially among children. While synthetic anthelmintic drugs are commonly used for treatment, their prolonged usage is often associated with side effects and the development of drug resistance. [1,2]
- In response to these challenges, there has been growing interest in exploring herbal alternatives derived from medicinal plants known for their traditional anthelmintic properties. Phytochemicals such as alkaloids, tannins, and flavonoids have shown promising activity against various helminths. Integrating such herbal extracts into a palatable delivery form like chocolate offers a novel approach to improve patient compliance, particularly among children. [3,4]
- This study focuses on the formulation and evaluation of a herbal chocolate infused with selected anthelmintic plant extracts. The aim is to develop an effective, safe, and consumer-friendly dosage form that combines the therapeutic benefits of herbal medicine with the acceptability and appeal of chocolate. [3]
- One of the finest delivery methods for patient compliance is oral. It offers advantages of its own. Chocolate is an incredibly sophisticated and adaptable delicacy that can be mixed to produce unique tastes and textures. Chocolate is resistant to microbial growth and the hydrolysis of active ingredients that are water-sensitive because it is anhydrous. In many ways, using chocolate as a delivery system for active compounds makes sense. For instance, chocolate's general characteristics are great for hiding the disagreeable flavors of active ingredients as well as giving otherwise unappealingly granular active ingredient compositions a smooth and creamy texture.[1,5]
- Chocolate is rich in Polyphenols, saturated fat, methylxanthines and aliphatic alcohols. Phenylethylamine, sometimes known as "the love drug." is a chemical that naturally arises in the brain and gives people a sensation of happiness and pleasure. Two advantages of the chocolate drug delivery technology include the potential bypass of first-pass effects and the prevention of pre-systemic elimination within the GI tract. Helminthiasis is the term for an infection of the human body with parasitic worms like

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roundworms, pinworms, etc. According to the WHO, helminthiasis is controlled through pharmacological therapy, biological control, good hygiene, and health education. Herbs known as anthelmintics can be used therapeutically to treat helminthiasis because they have qualities that either kill parasitic helminths and protozoal parasite worms or stop their growth or replication. [4,6]

- The herbs and fruits used in this polyherbal medicated chocolate have a vast variety of pharmacological use with context to stomach worms and their related issue. Banana peel contain compounds like tannins saponins alkaloids having a anthelmintic activity. Tulsi extract contain Eugenol shows anthelmintic activity, it is also used as antioxidant, anti-inflammatory, stress reduction, anticancer etc. Papaya Seed, pumpkin seed also having Anthelmintic activity.

➢ **Advantages: [2]**

1. Palatable Delivery Form: Chocolate masks the bitter taste of herbal extracts, increasing patient compliance, especially in children.
2. Natural Ingredients: Herbal actives reduce dependency on synthetic drugs, offering a more natural treatment option.
3. Dual Benefits: Combines the medicinal effect of anthelmintics with the nutritional/antioxidant benefits of cocoa.
4. Improved Acceptability: Easier to consume compared to syrups or tablets, especially in populations averse to traditional medicine.
5. Enhanced Bioavailability: Lipids in chocolate may improve the absorption of fat-soluble herbal compounds.
6. Cost-Effective: Herbal formulations can be more economical, particularly in areas where medicinal herbs are locally available

➢ **Disadvantages [2]**

1. Enhanced Palatability and Patient Compliance
   Problem: Herbal anthelmintics often have a bitter taste or unpleasant smell.
   Benefit: Chocolate masks the bitterness, improving compliance, especially in children and the elderly who are often more sensitive to taste.
2. Synergistic Effect
   Chocolate, especially dark chocolate, contains bioactive compounds like flavonoids, which may enhance the bioavailability or effectiveness of certain herbal components.
   The combination may result in synergistic therapeutic effects.
3. Novel Drug Delivery System
   Introducing a chocolate-based delivery system offers a novel way to administer natural medications, improving acceptability and convenience.
   Suitable for nutraceutical markets where functional foods are in demand.
4. Stability and Shelf-life
   Chocolate can act as a protective matrix, potentially enhancing the stability of volatile or sensitive herbal compounds.
   Helps in developing a product with a longer shelf-life.
5. Dosage Accuracy
   Formulation allows for standardized dosing, especially important in herbal medicine where active component concentrations can vary

➢ **NEED OF INVESTIGATION**

1. Drug Resistance

Increasing resistance to conventional anthelmintics necessitates alternative treatments. Cultural acceptance: In many regions, herbal remedies are more culturally accepted.

2. Innovation in Drug Delivery Systems

Improved palatability: Chocolate masks the bitter taste of herbs, improving patient compliance, especially in children.
Convenient dosage form: A solid, edible form like chocolate is easier to administer and store.
Controlled release potential: Lipid-based matrices in chocolate may influence drug release and absorption.

3. Potential Benefits of Chocolate as a Carrier

Natural antioxidant properties: Cocoa contains flavonoids that may complement herbal action. Biocompatibility: Cocoa butter and other chocolate constituents are safe for consumption.

4. Scientific Justification

Validation of traditional knowledge: Formal research can validate and quantify the efficacy of herbal ingredients used in folklore.
Standardization: Ensures dosage consistency, safety, and efficacy.
Phytochemical analysis: Helps identify active constituents responsible for anthelmintic activity.

5. Research Goals

To develop a stable and palatable formulation.
To assess the in vitro and in vivo anthelmintic activity.
To evaluate physicochemical properties, shelf-life, and acceptability. To perform comparative studies with standard anthelmintic drugs.

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❖ LITERATURE REVIEW

1. Aditi. A. Ghadage, Vrushali. R. Raut, Gaurav. D. Mahamulkar. Dhanashri. T. Jawal. 2. K. Khan [2024]

In the indigenous medical system, Calotropis gigantean is one of the most widely used and advantageous medical herbs for the treatment of asthma disorder. This thorough This thorough analysis offers the most recent information on the traditional uses, phytochemistry, pharmacological data, toxicological data, clinical, efficacy, safety and efficacy of Calotropis gigantean. It also lays out plares for future studies and development of substantiate the plant's plant's therapeutic potential through scientific mears. A through web and library search of numerous indexed and non-indexed journals, some local literature and a variety of publications published on ethno pharmacology, phytochemistry and traditional usage were used to gather information about Calotropis gigantean The p The pleiotropic advantages associated with Calotropis gigantean, comprising its toothache and Head ache Sprain. Stiff joints and to cure pain anthelmintic intestinal worms, ascites, and laxative and is useful in bronchitis, cutaneous disease, arthralgia swellings and intermittent fevers. Calotropis gigantean.

2. Najmin Ansar Shaikh, Sakshi Omprakash Jaju, Anand Daulatran Khendke [2024]

The consumption of chocolate is enjoyed by people of all ages, yet health concerns such as obesity, high blood pressure. diabetes, and coronary artery disease persist. 1 rast. The consumption of chocolate is enjoyed hy people of all ages, yet health concerns such as obesity, high blood pressure, diabetes, and coronary artery disease persist

3. Mahendra Dwivedil, K.K.Jha, Swati Pandey, Ankush Sachan, Himanshu Sharma, Shloke Kumar Dwivedi [2023]

The goal of this study is to develop and assess a polyherbal medicated chocolate for stomach deworming and other related issues that has higher bioavailability and compliance than standard treatment options. An effurn was undertaken to create a chocolate with a chocolate base with the addition of herbal fruits and spices for an easier and faster commencement of the action IJARIIE

4 K. Khan, Viraj. H. Lambhate, Rutuja R. Raut, Vaishnavi A. Jagadale, Dhanashri.T. Jawal [2023] the indigenous medical system. Tamminalia arjuna is one of the most widely usst and advantagens medicinal herbe for the westment of cardiovascular disorders. This though analysis offen the most meent information on the traditional uses, phytochemistry, pharmacological data, toxicological data, clinical efficacy, safety and efficacy y of Terminalia arjuna. It also lays out plans for development to substantiate the plant's therapeutic potential though scientific means further study and development to substantia substantiate the plant's therapeutic potential through scientific means. further study and Materials and Methods: A thorough web and library search of numerous indexed and non- indexed journals, some local literature and a variety of publications published ethnopharmacology, phytochemistry and traditional usage were used to gather information about Terminalia arjuna. Regarding the effectiveness and safety protile of Terminalia. arjuna, numerous pro-dinical (2000-2014)and clinical investigations (1990-2014) have also been taken into considention. The pleiotropic advantages associated with Terminalia arjana, comprising its unti- anti- athesogenic, hypotensive, inotropic, anti-inflammatory, anti- thammbotic and antioxidant properties, have been demonstrated in aumerous in vitro, vive and clinical investigations.

5. Dhanashree R. Thakare and Priyanka G.Dhumal [2023]

The chocolate is most loving food of children whereas medicine is hating substance. So, the objective of this study is to fabricate and design chocolate. The essential target of this study was to formalate and evaluate nutritious chocolate and nutritional supplement containing antioxidant and anti-cancer property. Chocolate is a range of products derived from cocoa (cocon) mixed with fat and finely powered coconut sugar to produce a solid confectionery, Ocimum sanctum, Tulsi is the herbal drug which having several medicinal properties, like antitussive property, antioxidant property, from the prevention of heart disease and also for the treatment of skin. Black sesame was used to improved blood pressure and as a anti aging agent. Thus, we have to formulate the chocolate with aqueous extract of black sesame and Tulsi that gives antitussive and anti-cancer activity. Chocolate is sophisticated and infinitely adaptable food that can be mixed and matched to generate a variety of taste and texture sensation, Henceworth, in the present IJARIIE

6. Ajay Patole, Mis. Y.L.. Ghule, Dr. Prachi Jain [2023

] The chocolate is most loving food of children whereas the medicine is hating substance. So, objective of present study was to formulate the chocolate that contain drug ie, medicated chocolate to prevent the disease. In children cough, viral infection sost common diseases. Ocimum sanctum, Tulsi is the herbal drug which having several medicinal properties, antitussive activity is one of prope them. Thus, we have to formulate the chocolate with aqueous extract tulsi that gives antitussive activity. Further, prepared medicated chocolate is evaluated for general appearance dimension, hardness, blooming test, drug content determination, physical stability etc. The main objective of the present invention to provide a novel herbal chocolate and a process for preparation of the product. To use in the viral infection weatment, in the children's.

7. **Kaushik Singh, Komal Shevkar, Omkar Selmekar, Prof, Poonam Harpale, Dr. Rajesh Oswal [2022]**

The chocolate is most loving food among the people whereas the medicine is hating substance. So, objective of present study was to formulate the chocolate that contain drug Le, medicated chocolate to prevent various kind of disorders. Withania somnifera (Ashwagandha) is an herbal drug which having several medicinal properties like Anti as anti-stress, anti-inflammatory effect and nervous system effect and Asparagus racemosus (Shatavari) is an herbal drug that has medicinal

8. Sharma Mayank, Jain Dinesh Kumar [2022]

Chocolate is highly sophisticated and infinitely a versatile food that can be combined to create completely different taste and texture

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sensations. The objective of the present study is to develop a palatable chocolate formulation of Domperidone and Cetirizine for pediatric administration and to increase patient's desire to consume the medication In present investigation chocolate base is prepared by use of coena powder, coco huner, lecithin, and pharmaceutical grade sugar. Thereafter drug is incorporated to prepared chocolate base. The medicated chocolate prepared is evaluated for appearance, moisture content determination using digital Karl Fischer titrator, blooming test, drug content determination & drug excipient interaction by differential scanning calorimetry.

9. Yogesh S. Kolekar1, Sajid A. Mulanil, Firoj A. Tambolil, Harinath N. Morel and Ashish A. Misal [2021]

The chocolate is most loving food of children whereas the medicine is hating substance. So, So, objective of present study was to formulate the chocolate that contain drug ie, medicated chocolate to prevent the disease. In children cough, viral infection is most common diseases. Ocimum sanctum, Tulsi is the herbal drug which having several medicinal properties, antitussive activity is one of them. Thus, we have to formulate the chocolate with aqueous extract of tulsi that gives antitussive activity. Further, prepared medicated chocolate is evaluated for general appearance, dimension, hardness, blooming test, drug content determination, physical stability ete VARIIC

❖ **AIM** : FORMULATION AND EVOLUATION ANTHELMINTIC HERBAL CHOCOLATE FOR PAEDIATRICS USE

❖ **OBJECTIVES**

- To select and extract active anthelmintic compounds from medicinal plants.
- To formulate herbal extracts into a chocolate base ensuring stability and uniformity.
- To evaluate the physicochemical and organoleptic properties of the formulated herbal chocolate.
- To assess the anthelmintic activity of the formulation through in vitro and/or in vivo models.
- To determine the acceptability and shelf-life of the herbal chocolate
- To identify and select suitable medicinal herbs with known anthelmintic properties (e.g., Tulsi, Neem, Ajwain, etc.).
- To extract active phytoconstituents from selected herbal materials using appropriate extraction techniques.
- To formulate a palatable chocolate-based dosage form incorporating the herbal extracts for pediatric and adult use.
- To evaluate the organoleptic properties (taste, texture, color, aroma) of the herbal chocolate formulation.
- To assess the physicochemical parameters of the formulated chocolate (e.g., melting point, moisture content, hardness, pH)
- To perform in vitro anthelmintic activity tests using model organisms like Pheretima posthuma (earthworms) to evaluate efficacy

❖ **PLAN OF WORK**

Formulating and evaluating an anthelmintic herbal chocolate involves several key steps. Here's a plan of work to guide the process:

1. Selection of Anthelmintic Herbs:
2. Formulation of Anthelmintic herbal chocolate:
3. Evaluation of Anthelmintic herbal chocolate:
   a) General appearance
   b) Weight variation
   c) Sugar bloom test
   d) Stability
   e) Dimension
   f) Anthelmintic activity
4. Report writing

❖ **EXPERIMENTAL WORK**

3.1 Materials

All the fruits and herbs are Ocimum Sanctum (Tulsi), Banana Peel, Papaya Seeds, Pumpkin Seeds, honey, chocolateBase.In addition to this equipment istaken as of analytical grade obtained from Gourishankar Institute of Pharmaceutical Education and Research Limb, Satara

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Fig No 1: Tulsi

A}TULSI LEAVES
Scientific Name: Ocimum Sanctum
Family: Lamiaceae
Common Name: Ajaka, Manjari (Sanskrit), Tulsi (Hindi), Thulasi (Tamil) 4.Varieties: Sri Tulsi, Krishna Tulsi,
Distribution: India, Andaman and Nicobar Islands **Uses**: Drugs, Flavouring, Insecticide, Perfumery etc **Active Constituents:** Essential oils (e.g., eugenol, methyl eugenol, and linalool). Flavonoids.
Tannins. Saponins. Alkaloids.
Medicinal Properties:
Anthelmintic: Effective against parasitic worms by disrupting their metabolism.

Antibacterial and antifungal. Antioxidant.
Anti-inflammatory. Immunomodulatory.
Role in Anthelmintic Herbal Chocolate
Purpose:
Tulsi extracts are incorporated into the chocolate to provide natural anthelmintic action while making the treatment more palatable, especially for children and individuals who struggle with traditional remedies.
Mechanism of Action:
Eugenol: Disrupts the cellular membrane of worms.
Flavonoids and Tannins: Bind to proteins, causing structural damage to the worms.
B} BANANA PEEL POWDER
Common Names: Banana (English), Kela (Hindi), Vazha (Tamil) Varieties: Cavendish, Gros Michel, Plantains, Lady Finger, etc.

Fig no 2:Banana peel

Distribution: Tropical regions worldwide
Uses: Consumed as fruit, cooking ingredient, source of fiber and vitamins, and in some cultures, the leaves are used for cooking or wrapping food Phytochemical Composition **Banana peels contain**: Tannins

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Saponins Flavonoids Alkaloids Glycosides
Phenolic compounds
These phytochemicals are known for their potential to:
Paralyze and/or kill helminths (worms)
Inhibit parasite metabolism or neuromuscular activity Prevent egg hatching and larval development **Mechanism of Action :**
Tannins and saponins may interfere with the energy metabolism of helminths.
Alkaloids and flavonoids can cause paralysis or disruption in the parasite's neural transmission. Combined effects can lead to expulsion or death of worms.

Role in Chocolate-Based Delivery

Chocolate serves as a palatable medium that masks the bitterness of plant extracts. The lipid content also enhances the absorption of phytochemicals. Banana peel powder can be:

C} PUMPKIN SEED

Scientific Name: Cucurbita pepo (for most common varieties)
Family: Cucurbit aceae

Fig no 3: Pumkin Seed

Common Names: Pumpkin (English), Kaddu (Hindi), Poosanikai (Tamil)
Varieties: Jack-o'-lantern, Sugar Pie, Cinderella, etc.
Distribution: Cultivated worldwide in temperate and tropical regions.
Common use: Traditionally used in herbal medicine for treating intestinal parasites, especially tapeworms.
Active Constituents:
Cucurbitin: A bioactive amino acid known for its anthelmintic properties. Fatty acids: Such as oleic and linoleic acid which may enhance bioavailability.

D}PAPAYA SEED

Scientific Name: Carica papaya
Family: Caricaceae
Common Name: Papaya
Varieties: Hawaiian, Mexican, Solo, Sunrise
Distribution: Tropical regions worldwide
Uses: Clinary, Medicinal, Cosmetic, Seeds as Vermifuge
Mechanism of Action
The exact mechanism isn't fully elucidated, but:
Isothiocyanates may inhibit mitochondrial enzymes in parasites.
Saponins and tannins may disrupt the integrity of worm membranes or cuticle.

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Fig no 4: Papaya Seed

E} Punica granatum
Botanical Name: Punica granatum **Common Name**: Pomegranate **Family**: Lythraceae
Parts Used: Peel, rind, bark, and sometimes seeds
Phytochemical Composition :
Punica granatum contains several biologically active compounds that contribute to its anthelmintic properties
Tannins
Alkaloids (e.g., pelletierine) Flavonoids
Gallic acid Ellagic acid Punicalagins
These compounds are known to paralyze or kill helminths (worms) by interfering with their neuromuscular activity or damaging their cuticle.
Mechanism of Anthelmintic Action:
Tannins can bind to free proteins in the gastrointestinal tract of hosts or glycoproteins on the parasite cuticle, leading to paralysis or death of the helminths.
Alkaloids like pelletierine have a neurotoxic effect on worms. Ellagitannins may cause oxidative stress in parasites, damaging their cells.

Fig no 5:Punica Grantum

METHODOLOGY

1. **Extraction of Fruits Used in Formulation:**

Fig no 6: Extraction of Fruits used in formulation

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1. Banana fruits were purchased from a nearby fruit market. Manually separating the peels, allowing them to dry in the shade, and preserving a sample allowed for future research.
2. The dried peels were mechanically ground into powder. The powdered plant material is extracted repeatedly using various solvents, including water, methanol, and chloroform.
3. Maceration was used for extraction using methanol and chloroform.\
4. Soxhlet apparatus is used to produce an aqueous extract. The process that was used was as follows: For six days, chloroform is macerated with the powder.
5. Then vacuum filtration is used to filter the contents. The same solvent is used to treat the marc once more for three days. Filtered, blended, and concentrated materials are used. Following methanol extraction, the solid material was suitably dried before being subjected to an eighthour soxhlet extraction with water. It was a concentrated extract. A desiccator was used to store each extract

2. **Extraction of Tulsi leaves**

Preparation of Sample:

Collect fresh Tulsi leaves and wash them thoroughly. Dry them under shade (not direct sunlight) for a few days. Once dried, crush into a coarse powder using a mortar and pestle.

1. Weighing the Sample:

Take around 10–20 grams of the powdered Tulsi leaves.

2. Packing the Sample:

Place the powdered leaves into a filter paper thimble or wrap it in filter paper. Ensure the material is tightly packed but allows solvent percolation.

3. Setting Up the Apparatus:

Place the thimble into the Soxhlet extractor chamber.

Attach the extractor to a round bottom flask (containing solvent) and a reflux condenser on top.

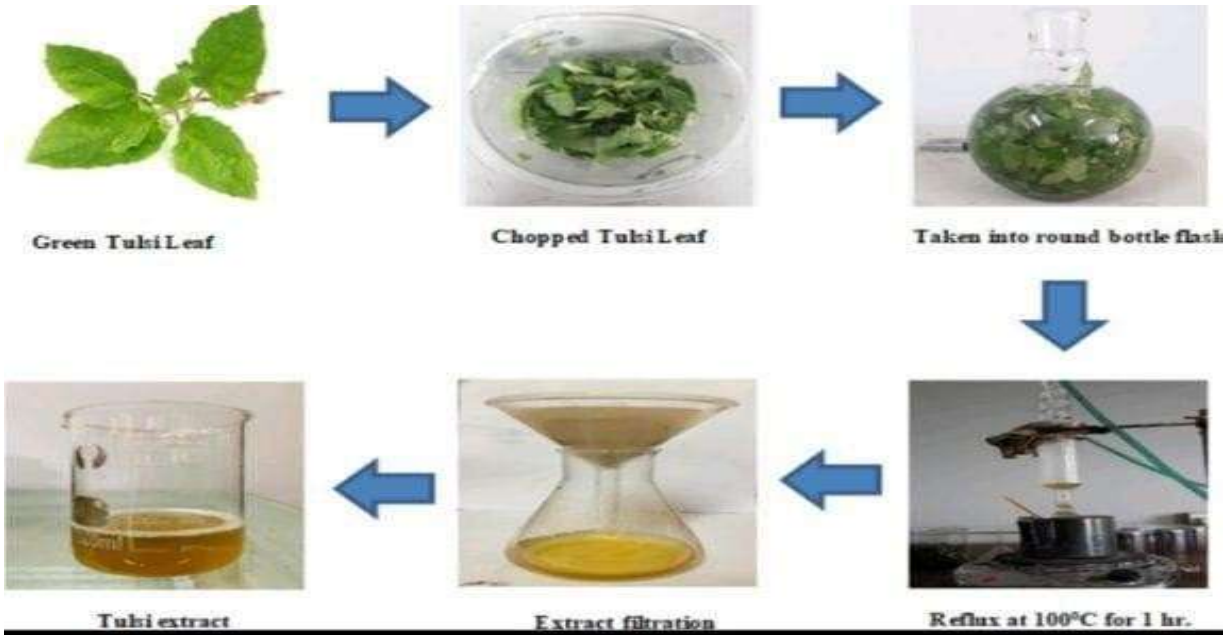

Fig no 8. Extraction of Tulsi Leaves

4 Choosing the Solvent:

Fill the round bottom flask with a suitable solvent (e.g., 200 ml ethanol or methanol).

4. Heating:

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Place the entire setup on a heating mantle or water bath.
Heat gently to allow the solvent to boil and condense in the condense
5. Extraction Cycle:
The condensed solvent drips into the chamber with the Tulsi powder.
When the level reaches the siphon arm, the solvent (with extracted compounds) siphons back into the flask. This cycle repeats for 4–6 hours or until the solvent becomes colorless.
6. Post-extraction:
After extraction, remove the solvent (filtrate) from the flask Concentrate the extract using a rotary evaporator or simple distillation.
7. Drying: Dry the final extract in a desiccator or under reduced pressure.
8. Storage: Store the dried extract in a sealed container or vial for further analysis.

3 Extraction of papaya seed:

Fig no 7: Extraction of Papaya seed

Grinding

1. Start by grinding the papaya seeds into a fine powder using a mortar and pestle or a grinder.
2. Packing the Soxhlet apparatus: Place the ground papaya seed powder into the thimble of the Soxhlet extractor. Make sure the thimble is properly packed but not too tightly to allow for proper extraction.
3. Solvent selection: Choose an appropriate solvent for extraction. Ethanol or a mixture of ethanol and water is commonly used for extracting phytochemicals from plant materials.
4. Solvent circulation: Set up the Soxhlet apparatus with the extraction flask containing the selected solvent and the condenser. Heat the flask to boil the solvent, causing it to vaporize and rise into the condenser.
5. Continuous extraction: As the solvent vapor condenses, it drips onto the packed papaya seed powder in the thimble, extracting the desired compounds. The solvent then evaporates, rises, and repeats the cycle. This continuous process ensures efficient extraction.
6. Extraction duration: Allow the Soxhlet apparatus to run for several hours or overnight to ensure maximum extraction efficiency.
7. Collection: The extracted solution collects in the extraction flask. Once the extraction is complete, remove the flask from heat and allow it to cool down.
8. Concentration: If necessary, concentrate the extract by evaporating the solvent using a rotary evaporator or similar equipment.
9. Filtration: Filter the concentrated extract to remove any remaining solid particles or impurities.
10. Storage: Transfer the filtered extract into a clean, airtight container and store it in a cool, dark place to maintain its stability and efficacy

4 Pumpkin Seed Powder

1. Selecting and Cleaning: Start by selecting fresh, high-quality pumpkin seeds. Remove any debris or dirt from the seeds by rinsing them in water.
2. Drying: Spread the cleaned pumpkin seeds in a single layer on a baking sheet and allow them to dry completely. This can be done either by air-drying them for a few hours or by roasting them in the oven at a low temperature (around 150°F or 65°C) for about 15-20 minutes.
3. Grinding: Once the pumpkin seeds are dry, transfer them to a food processor or a high- powered blender. Pulse or blend the seeds until they form a fine powder. You may need to stop and scrape down the sides of the processor or blender periodically to ensure even grinding.

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Fig No 9: Pumkin Seed Powder

Storage: Transfer the pumpkin seed powder to an airtight container and store it in a cool, dry place away from direct sunlight. It can be stored for several weeks to a few months, depending on the conditions.

5 Extraction Process of punica granatum

1. Plant Material Collection and Preparation
2. Plant part used: Typically Punica granatum peel or bark, as they contain high levels of tannins and alkaloids with anthelmintic activity.
3. Drying: Shade-dried to preserve phytochemicals.
4. Powdering: Dried material is ground into a coarse powder. Method:Soxhlet extraction or maceration.
5. Solvent: Hydroalcoholic (ethanol:water in 70:30 or 50:50 ratio) or aqueous extraction is preferred for food-safe formulations.
6. Duration: 6–8 hours (for Soxhlet); 48–72 hours (for maceration).
7. Filtration and Concentration: The extract is filtered and concentrated under reduced pressure using a rotary evaporator.
8. Drying: Concentrated extract is dried (e.g., in a vacuum oven) and stored in a desiccator

❖ **FORMULATION OF ANTHELMINTIC HERBAL CHOCOLATE**

Procedure

1. Prepare the Ingredients

- Grind banana peels and Tulsi leaves separately and extract the juices. You should have 2 grams of banana peel extract and 1.2 grams of Tulsi extract.
- Grind papaya seeds and pumpkin seeds separately into fine powders. You should have 0.8 grams of each powder.
- Measure 2 grams of honey.

2. Chocolate Base Preparation

- Melt 3 grams of chocolate base in a double boiler or microwave until smooth. Allow it to cool slightly.

3. Mixing

- In a mixing bowl, combine the melted chocolate with the following:
- 2 grams of banana peel extract
- 1.2 grams of Tulsi extract
- 0.8 grams of papaya seeds powder
- 0.8 grams of pumpkin seeds powder
- 0.5 grams of punica grantum extract
- QS grams of honey
- Stir the mixture thoroughly until all ingredients are well incorporated.

4. Pouring and Setting

- Pour the mixture into a chocolate mold or onto a lined baking sheet.
- Allow the chocolate to set at room temperature or in the refrigerator until firm.

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5. **Storage**
   - Once the chocolate has set, store it in an airtight container in a cool, dry place.
6. **Dosage Consideration**
   -Determine the dosage per serving based on the potency of your extracts and powders.
   Label the chocolate accordingly with dosage information.
7. **Testing and Packaging**:
   - Test the medicated chocolate for taste, texture, and potency Once satisfied, package the chocolate attractively and include dosage information on the packaging.

SR.NO	Ingredients	Intended use	Quantity gm or ml
1	Banana Peel Extract	Antiparasitic, Preventing constipation, Anthelmintic	2ml
2	Tulsi Extract	antimicrobial and anthelmintic effects, reduces inflammation, boosts immunity, and supports digestive health.	1.2ml
3	Papaya seed powder	It help to expel parasitic worms ,paralyzes or kills worms	0.8gm
4	Pumpkin seed powder	paralyzing the worms, preventing them from holding onto the intestinal walls	0.8 gm
5	Punica grantum	Ellagitannins may cause oxidative stress in parasites, damaging their cells	0.5 ml
6	Chocolate base	Palatability, Bioavailability, Masking Flavor	3gm
7	Honey	sweetening agent	qs

❖ **EVALUATION OF ANTHELMINTIC HERBAL CHOCOLATE**

1. **General appearance**
   The visual identity and overall elegance of a chocolate formulation are what determine its overall appearance, which is important for consumer acceptability and trouble-free manufacture
2. **Dimensions:**
   The dimension of the chocolate was evaluated while using Vernier's callipers
3. **Moisture content determination:**
   A desiccator was used to determine the moisture content. This test was performed to determine the level of moisture in the chocolate when it was dry. The resulting chocolate mixture was precisely weighed and stored in a desiccator with anhydrous silica gel. After 24 hours, the formulations were removed, weighed, and the percentage of moisture absorption was determined using the formula
   %Moisture = initial weight-final weight
   Final weight
4. **Weight Variation:** Five chocolate recipes were weighed separately and collectively. The weight of all the chocolate was used to calculate the average weight. The average weight was contrasted with the individual weights. The weight variation's percentage difference must stay within the allowed bounds. The following formula was used to determine the per cent deviation %Deviation= (Individual weight – Average weight)/Average weight ×100
5. **Stability:** Medicinal products are defined as being stable if they can maintain their physical, chemical, microbial, therapeutic, and toxicological specifications in a specific formulation in a specific container. To put it another way, the stability of a drug is its capacity to withstand degradation. The lowest permissible potency level is typically accepted to be 90% of the labelled potency. Due to changes in its physical, chemical, and microbiological properties, drug degradation can happen in a variety of ways. The modifications could reduce the preparation's medicinal efficacy or raise its toxicity.
6. **Sugar bloom test:** This is a rough and irregular layer on top of the chocolate formulation. Sugar bloom is caused by condensation (when the chocolate is taken out of the refrigerator). This moisture will dissolve the sugar in the chocolate. When the water evaporates afterwards, the sugar secrystallizes into rough, irregular crystals an the stuface This gives the chocolate an uppicasant look Each sample was subjected to treatment cycles comprised (1) 30°C for 11 hours, (2) temperature shifting for 1 hour, (3) 18°C for 11 hours, and (4) temperature shifting for 1 hour. A est chocolate formulation observed, after the step at 18°C for 11 hours, whether or not blooming has taken place.
7. **Anthelmintic activity**

❖ **Experimental Model**

Adult earthworms were collected and grouped for the study, Piperazine citrate used as the standard drug. Concentrations of both the standard drug and the herbal chocolate formulation were prepared.
Anthelmintic Activity: Groups of earthworms were treated with normal saline (control) herbal chocolate formulation, and standard drug. Paralysis and death times were recorded for each group

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Fig no 10: **Anthelmintic activity on Earthworms**

❖ RESULTS AND DISCUSSION

A. Organoleptic Properties

Sr. No.	Characteristics	Result
1.	Colour	Brown
2.	Odour	Pleasant with no burnt smell
3.	Taste	Sweet
4.	Surface	Smooth & even

B. Dimensions

It was measured by Vernier's callipers Avg. width of 5 chocolate formulations:
1.85 + 1.90+ 1.84 + 1.85 +1.86 / 5
The average width of 5 chocolate is observed to be = 1.86

C. Moisture Content Determination:

Weight of Formulated chocolate = 7.8gm Weight of empty Crucible = 45.32 gm
Weight of formulated chocolate + weight of empty crucible = 53.12 gm Weight after moisture loss = 53.03 gm
Therefore, the final weight obtained = 0.09gm
Weight of one formulated chocolate = Final weight obtained
7.8gm = 0.09gm 100gm = X
X = 0.09×100 /7.8
So, the percentage of moisture content = 1.15%

D. Sugar bloom Test:

Sugar bloom is characterized by a rough and irregular layer on top of the chocolate formulation.

This phenomenon occurs due to condensation when the chocolate is taken out of the refrigerator. The moisture dissolves the sugar in the chocolate, and as the water evaporates, the sugar recrystallizes into rough, irregular crystals on the surface, giving the chocolate an unpleasant look.

Fig no 11: Observation from bloom test of Chocolate

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E. Weight Variation Determination

Average Weight of 5 formulations: W1+W2+W3+W4+W5/ 5 Average weight calculated to be: 7.68+7.71+7.62+7.65+7.60/5

= 38.26/5 = 7.692

F. Stability Testing

After being kept at room temperature for 24 hours in the foil container with shiny butter paper on the outside.

H.Anthelmintic Activity

Sr. No.	Treatment	Concentration(gm%)	Paralysis Time (min)
1.	Normal saline	0.5	
2.	Herbal chocolate sol.	0.5	25 ± 3
3.	Piperazine citrate	0.5	30± 2

The herbal chocolate formulation exhibited significant anthelmintic activity, with the ethanolic extract showing higher efficacy compared to the aqueous extract. Further research is warranted to explore its application in combating helminth infections in humans and animals.

❖ FUTURE SCOPE

- Novel Drug Delivery System: Chocolate as a palatable and patient-friendly medium enhances compliance, especially in children and elderly populations.
- Herbal Alternatives: Growing interest in natural and plant-based remedies supports further exploration of herbal extracts with anthelmintic properties.
- Phytochemical Standardization: Future research can focus on standardizing and optimizing the active constituents in herbal ingredients to ensure consistency and efficacy.
- Enhanced Bioavailability: Use of chocolate as a lipid-rich base may improve solubility and bioavailability of herbal actives.
- Toxicological Studies: Long-term safety studies and toxicity profiling are necessary for regulatory approval and public health assurance.
- Formulation Optimization: Research can explore various chocolate bases, sweeteners, and stabilizers to improve shelf-life, stability, and taste.
- Clinical Trials: Scope for conducting human clinical studies to establish therapeutic effectiveness and dosage guidelines.
- Integration with Nutraceuticals: Potential to market as a functional food or nutraceutical, combining nutrition with therapeutic effects.
- Commercial Potential: Attractive product format can lead to commercial interest and scalable production in the pharmaceutical and wellness sectors.
- Regulatory Pathways: Development of regulatory frameworks for herbal edibles in pharmaceuticals will open new avenues for approval and distribution

❖ CONCLUSION

In conclusion, based on the above-mentioned study, we can say that medical chocolate with ingredients like banana extract, apple peel extract, s. chirata, and Ferula asafoetida, which have a bland flavour, are smooth in texture, pleasant to the taste, and have patient compliance and safety for stomach deworming. The shape, size, taste, texture, dimensions, moisture content, bloom test, viscosity, weight variation, hardness, and stability of the formed chocolate were all analyzed. We concluded from the study that medicated chocolate gives the formulation a smooth and creamy texture and is effective at disguising unpleasant tastes while achieving a greater therapeutic effect.

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