International Journal of Scientific Research & Engineering Trends
Volume 12, Issue 3, May-Jun-2026, ISSN (Online): 2395-566X

Development and Evaluation of Polyherbal Candy for Immune Support in Dengue

Ms. Snehal Kadbhane[1], Ms. Bhagyashri Shankar Thorbole[2], Ms.Nikita Sanjay Pachange[3], Dr. Vijaykumar Kale[4], Dr. Mahesh Thakare[5]

[1]Assistant Professor Department of Pharmaceutics Kasturi Shikshan Sanstha College of Pharmacy, Shikrapur, Pune-412208.
[2,3]Kasturi Shikshan Sanstha College of Pharmacy, Shikrapur, Pune-412208
[4]Principal Department of Pharmacology Kasturi Shikshan Sanstha College of Pharmacy, Shikrapur, Pune-412208
[5]HOD Department of Pharmaceutics Kasturi Shikshan Sanstha College of Pharmacy, Shikrapur, Pune-412208

Abstract- In this study, making of polyherbal candy for treatment of Dengue is the primary goal, using natural ingredient to treat the dengue fever and boost the immunity against Dengue. Dengue fever is a flu-like illness transmitted by female mosquitos of the Aedes aegypti species. Another name for it in Ayurveda is dandaka jwara. It is particularly prevalent in tropical and subtropical climate zones worldwide. Common symptoms of dengue include vomiting, a strong headache, nausea, rashes, joint discomfort, pain behind the eyes, muscular pain, and enlarged glands. Platelets play a crucial role in blood coagulation. During the course of their infection, DENV [Dengue Virus] patients frequently experience thrombocytopenia, making them susceptible to bleeding symptoms and other serious consequences. It also causes bone marrow depression and reduces platelet production. The active constituent carica papaya which increasing the number of platelet count and it shows the Anti-inflammatory and Anti-viral activity. Giloy sativa increases platelet count and speeds up the recovery process and also during dengue fever helps to strengthen the immune system. Other ingredients in formulation such as Sugar, Gum acacia, Lemon juice, Beetroot (powder) helps in reducing dengue symptoms, such as fever and pain, and improving patient outcomes. The development of herbal candies for dengue therapy is a novel and promising approach to disease management, with potential advantages for both patients and healthcare systems.

Keywords- Polyherbal Candy, Dengue Fever, Herbal Formulation, Supportive Management, Platelet Supportive Activity, Immunomodulatory Activity.

I. INTRODUCTION

Dengue fever is one of the world's most frequent neglected tropical diseases, and viruses (DENVs) have spread over the world. The number of dengue sufferers has increased by 30 times in the last 50 years. The people living in the tropical and subtropical zones have suffered the most. Several investigations have identified hematological abnormalities in dengue patients. The most commonly reported abnormalities are thrombocytopenia in 40%-79% of patients, leucopenia in 30%-69% of cases, and changes in lymphocyte populations, including lymphocytosis in 31.9% and lymphocytopenia in 67.2% of cases. Carica papaya leaves have long been used in South Asian countries as a traditional dengue treatment. Carica papaya contains anti-inflammatory, antiviral, cancer-fighting, anti-diabetic, and antioxidant properties. Papaya contains many necessary elements, including vitamins C, A, and E, as well as minerals such as magnesium (Mg) and potassium (K). Furthermore, it contains enzymes like papain and chymopapain that aid in digestion, promote wound healing, and reduce inflammation.Platelets are nucleated or nonnucleated blood cells formed in the bone marrow that help to maintain hemostasis. Low platelet count (100 x 103 cells/μL), often known as thrombocytopenia, and/or poor platelet activity can cause spontaneous bleeding. The processes of thrombocytopenia and bleeding following DENV infection are not completely understood. Several hypotheses have been proposed to explain the mechanism involved. In this situation, DENV may directly or indirectly disrupt the activity of bone marrow progenitor cells, reducing hematopoietic cell proliferation.

Dengue Condition in India : According to global data, India accounts for one-third of the global dengue burden, with an

estimated 33 million clinically evident cases per year. Dengue fever infections and fatalities are on the rise in India's cities and rural areas. Dengue fever has increased in India due to urbanization, lifestyle changes, and poor water management. This has led to the spread of mosquito breeding sites in urban, peri-urban, and rural areas. Disease has a seasonal pattern, peaking after the monsoon and not evenly spread throughout the year.

Affected States/UTs	2019		2020		2021		2022		2023		2024*	
	C	D	C	D	C	D	C	D	C	D	C	D
Maharashtra	14907	29	3356	10	12720	42	8578	27	19034	55	19382	26

Dengue Cases and Deaths in the Country since 2019- 2024

Mosquito Vector and Transmission of Dengue:Dengue fever is a mosquito-borne viral disease caused by the dengue virus and is primarily transmitted through the bite of infected female Aedes aegypti mosquitoes. These mosquitoes are considered the major vectors responsible for the spread of dengue infection in tropical and subtropical regions. The mosquito becomes infected when it bites a person already infected with the dengue virus. After entering the mosquito, the virus multiplies within its body and can then be transmitted to healthy individuals through subsequent bites. Aedes aegypti mosquitoes generally bite during the daytime, especially during early morning and late afternoon hours. These mosquitoes commonly breed in clean stagnant water found in household and surrounding areas such as water storage containers, coolers, flower pots, discarded tires, plastic containers, and water tanks. Poor sanitation and water accumulation increase mosquito breeding and contribute to the spread of dengue infection. Once the infected mosquito bites a healthy individual, the dengue virus enters the bloodstream and begins to infect immune cells and other body tissues.

Types of Mosquitoes Associated with Dengue Transmission

- **Aedes aegypti** – Primary vector responsible for transmission of dengue virus.
- **Aedes albopictus** – Secondary vector involved in dengue transmission.
- **Anopheles –** Responsible for transmission of malaria.
- **Culex –** Associated with filariasis and certain viral infections.

For dengue specifically:

The major mosquito responsible for transmission is Aedes aegypti because it efficiently carries and spreads the dengue virus among humans.

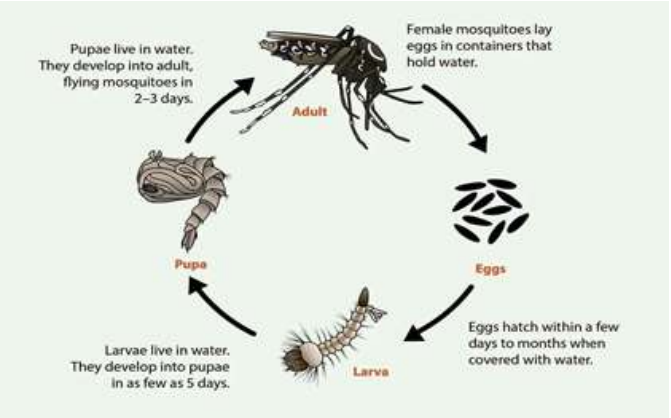

Fig No 1: Life cycle of Aedes mosquito (Egg → Larva → Pupa → Adult)

Transmission of Aedes Mosquito: The Aedes aegypti mosquito is the primary vector responsible for the transmission of dengue virus. The life cycle of mosquito consists of four stages: egg, larva, pupa, and adult mosquito. Female mosquitoes lay eggs in clean stagnant water present in containers, water tanks, flower pots, and discarded tires. Under favorable environmental conditions, the eggs hatch into larvae, which later develop into pupae and finally become adult mosquitoes. The adult female mosquito feeds on human blood and plays an important role in transmitting dengue virus from infected individuals to healthy persons.

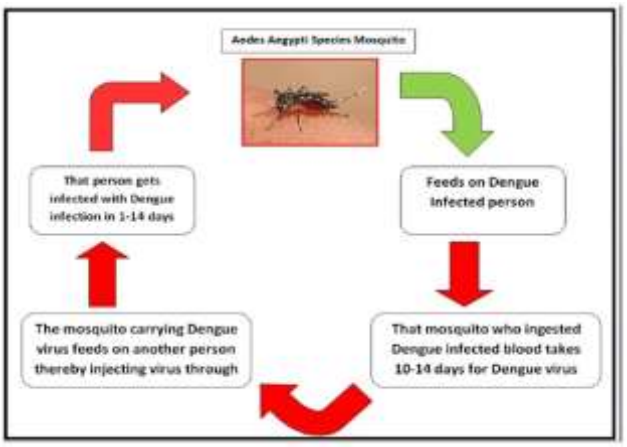

Fig No 2: Transmission of Aedes mosquito

Life Cycle of Transmission of Dengue in Human Being : Aedes aegypti mosquitoes are the primary vectors of the Dengue virus, with a few other species, including Aedes albopictus, Aedes polynesiensis, Aedes scutellaris, and others, also playing a role. Through blood consumption, an infected mosquito can spread the virus to people. In order to obtain access to the host's cellular machinery for its own replication, an RNA virus like DENV must make contact, attach, and infiltrate the vulnerable host. The female pathogenic Aedes aegypti mosquito's salivary gland secretes the Dengue virus into the skin of the mammalian host. In the vector's secondary tissue, such as the salivary glands, viral replication begins.

II. PATHOGENESIS OF DENGUE VIRUS

Dendritic cells and skin-resident macrophages are the cells that initially come into contact with the infection. Monocytes and macrophages are exposed to infection when these infected cells make it to the lymph nodes. Because the virus is present in distant lymph nodes and drains, the DENV infection develops into viremia. Previously, DENV infection was noted in the liver, lungs, kidneys, and spleen via DCs, monocytes, and macrophages.

These cells are thought to be the primary sites of viral replication and are among the most researched. The viremia condition can persist for 10– 12 days and can be identified as early as 24–48 hours before the start of clinical symptoms. If a mosquito feeds on blood during an individual's viremic stage, it becomes infected and remains infected for life. The virus lives and multiplies within mosquitos, and after a 4- to 10-day incubation period, the mosquito transmits the virus to humans and passes it on to its young, increasing the number of DENV vectors.

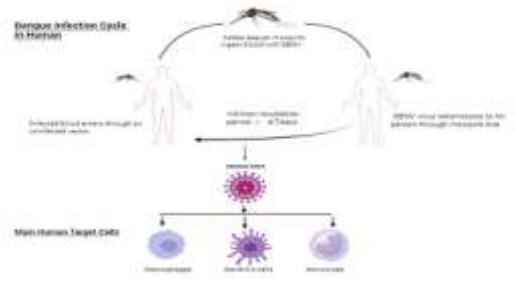

Fig. No. 3 [Dengue Infection Cycle]

Dengue is a viral infection characterized by one or more of the following symptoms: high temperature > 40°C, headache, retro-orbital pain, nausea/vomiting, myalgia, arthralgia, and rash. Additional objective findings indicated on WHO guidelines that indicate probable dengue include accumulation of fluid, liver enlargement, a positive pressure test, leukopenia, and thrombocytopenia.

Symptoms of Dengue

- High fever (40°C or above)
- Severe headache
- Pain behind the eyes
- Muscle pain
- Joint pain
- Nausea and vomiting
- Skin rash
- Fatigue and weakness
- Loss of appetite
- Abdominal pain
- Mild bleeding from nose or gums
- Decreased platelet count (thrombocytopenia)

Complications of Dengue:

- Dengue Hemorrhagic Fever (DHF)
- Dengue Shock Syndrome (DSS)
- Severe Thrombocytopenia
- Internal Bleeding
- Organ Damage
- Multi-organ Failure

Candy: - Candy is a common product that is consumed by both young and old. Its primary ingredient, sugar, provides an immediate energy boost. It is typically combined with a range of flavors and colors to enhance its visual appeal and sensory appeal. Products derived from herbs have higher health advantages and therapeutic actions with lower side effects.

Classification of Candy

1. Hard Candy
2. Soft Candy
3. Sugar-Free Candy
4. Jelly Candy
5. Chewing Gum
6. Chocolate Candy

Hard Candy: In the present study, hard candy was selected as a suitable dosage form for incorporation of herbal ingredients used for supportive management of dengue. Hard candy is also called as rock candy. Hard candies usually created from boiled

sugar syrup, hard sweets have a solid, firm texture. They have a wide range of forms, hues, and tastes, and frequently contain components like flavorings, fruit extracts, and essential oils. The sugar content of herbal hard candy is lower, and natural extracts and ingredients, as well as coloring foods, are expected to be among the most popular in the future.

Advantages of Hard Candy

1. Provides better patient acceptability due to pleasant taste.
2. Helps in masking the bitter taste of herbal extracts.
3. Easy to administer and consume.
4. Improves patient compliance.

Importance of Hard Candy:

- Helps in masking the bitter taste of herbal ingredients.
- Improves patient compliance and acceptability.
- Provides a convenient and patient-friendly dosage form.
- Easy to administer, especially for pediatric and geriatric patients.
- Enhances palatability of herbal formulations.
- Provides better stability due to low moisture content. o Easy to carry, store, and transport.
- Serves as an effective carrier for herbal extracts and active constituents. o May improve overall therapeutic effectiveness through better patient adherence.

III. MATERIAL AND METHOD

Roles of selected drugs in herbal candies

Fig.no.6 [C. Papaya's Leaves]

1) Carica Papaya
Biological Name – Carica papaya
Kingdom- Plantae
Division- Magnoliophyta
Class – Magnoliopsida
Order - Brassicales
Family – Caricaceae
Genus – Carica
Species - Carica papaya

2) Giloy
Biological name – Tinospora cordifolia
Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliophyta
Order: Ranunculales
Family: Menispermaceae
Genus: Tinospora
Species: T. cordifolia

Fig No 5: Giloy

3) Beetroot

Role-Hemoglobin supportive activity, Antioxidant Activity

Biological name – Beta vulgaris
Kingdom – Plantae
Division – Magnoliophyta
Class – Magnoliopsida
Order – Caryophyllales
Family – Amaranthaceae
Genus – Beta
Species – Beta vulgaris

4) Lemon juice (citrus fruit) –
Role: Rich Source of Vitamin C, Enhance Immunity

Fig.no. 9 [Lemon Juice]

5) Gum Acacia –
Role: Binding Agent, Stabilizing Agent

Formulation Table

Table No. 2

Sr.no.	Ingredients	Quantity	Role
1	Carica Papaya	2.5g	Platelet supportive activity
2	Giloy	1.5g	Immunomodulator
3	Sugar	32.5g	Sweetener, facilitates dissolution in mouth
4	Gum acacia	0.5g	Binder
5	Lemon juice	0.5ml	Preservative
6	Beetroot	2.5g	Colouring agent
7	Orange oil	2-3 drops	Flavouring agent
8	Water	Q.S.	Vehicle

Procedure:
Preparation of sample and apparatus setup : Carica Papaya leaves were collected from Kasturi College of Pharmacy Shikrapur , Botanical Garden. The leaves were cleaned with tap water and distilled water, chopped into small pieces, and dried at room temperature for 7-8 days before being placed in a hot air oven at 50°C for two hours. The dried leaves were crushed to a fine powder using a grinder, and the powdered sample was stored in clean, closed containers until extracted.

Extraction by Soxhlet Apparatus :The extraction was performed using a Soxhlet apparatus using water as a solvent. The leaf powder and solvent were 16 g and 100 mL, respectively. The finely grounded leaves were placed in a filter paper bag and placed in a Soxhlet thimble and avoid leakage. The vapours were condensed after heating the extraction solvent in the flask. The condensed extract dripped into the filter paper bag, which contained the leaf powder. When the liquid level in the chamber reached the top of the siphon tube, the liquid from the chamber siphon was collected into a flask. The technique was repeated until the siphon tube was empty. After completion, the extract was collected and the solvent was evaporated.

Table No. 3

Phytochemicals	Procedure	Inference
Alkaloids	Sample solution is treated with Picric acid.	
Flavonoids	Sample solution is treated with few drops of ferric chloride	
Carbohydrates	In sample solution add few drops of alpha naphthol and add concentrated H_2SO_4 from the edges of the test tube	
Steroids	2 ml of chloroform and 2 ml of concentrated H2SO4 were mixed with sample solution.	

Method for preparation of candy
In a deep-bottomed saucepan, water and sugar were combined, brought to a boil, and then a small amount of butter and salt were added. Using a wooden spoon, stir the mixture.

C. Papaya and other powders was added one at a time while being continuously stirred.

Preservative and a flavoring ingredient were added to the mixture.

The contents were promptly poured into the candy mold (sprayed with vegetable oil to prevent the mixture from sticking to the mold wall) and left to cool in the cooling racks.

Once cooled, the contents were stored appropriately at a suitable temperature.

IV. EVALUATION OF HERBAL CANDY

Quality Evaluation of Herbal Candy A. Preliminary phytochemical analysis:

1) Test for Carbohydrates:

i. Molisch's test:

When adding a few drops of alpha-naphthol solution in alcohol to the crushed candy sample, shaking it, and adding concentrated H2SO4 from the edges of the test tube

ii. Fehling's test:

1 ml of Fehling's A and 1 ml of Fehling's B solutions were combined and heated for one minute over crushed candy. After 5–10 minutes of heating in a boiling water bath

2) Test for Alkaloids: -

i.. Dragendroff's Test:

The crushed candy was treated with a few drops of Dragendroff's reagent, which produced

ii. Mayer's Test:

After adding a few drops of Mayer's reagent to the crushed candy,

iii. Hager's Test:

Hager's reagent was added to the crushed candy, and a yellow precipitate was observed.

3) Tests for Steroids:

i. Salkowski reaction:

2 ml of chloroform and 2 ml of concentrated H2SO4 were mixed with 1 gram of crushed candy. Shake vigorously and observe

4) Tests for Flavonoids: -

i. Shinoda Test: -

Add 0.5 g of magnesium turnings, 5 ml of 95% ethanol, and a few drops of concentrated HCl to the candy powder.
Lead acetate solution was added to a small amount of residue,

ii. Ferric chloride Test: -

A few drops of ferric chloride solution were added to the powdered candy,

B. Physicochemical Test

1. **Friability Test:** - Friability is another indicator of a candy's strength. The Roche Friabilator is a plastic circular chamber that rotates at 25 rpm and drops the candies six inches away with each revolution, allowing us to assess friability. After dusting, the candy`s are weighed again.

2. **Disintegration Test: -** In an appropriate disintegration time machine, six candies and sliding discs were placed. A constant temperature of 25°C was maintained for the water. After starting on the disintegration machine, the amount of time required to break up all six candies was recorded and the average time was determined.

3. **Hardness Test**: To determine hardness, The Monsanto hardness tester is used; in this test, a candy is placed between two anvils, force is applied to the anvils, and the crushing strength that causes the candy to break is measured. Before beginning the experiment, zero readings are taken. The candy's hardness was measured in kilograms per square centimeter and the average hardness was reported.

4. **pH measurement**: To determine the acidity or alkalinity of candy, a lab pH meter with a range of 1 to 14 was used. A 1%w/v solution of candy was made by dissolving 1 gram in 100ml of distilled water and the pH was recorded.

5. **Moisture Content**: The candy's moisture content was determined using the hot-air oven method. A candy sample was heated to 100±5°C in a hot air oven for 4 hours. It was allowed to cool in the desiccator before being weighed again and a reading taken. The quantity of moisture in the sample was determined by the weight differences.

V. RESULT AND DISCUSSION

Table No. 4

Evaluation Test of Candy:

Parameter	Result
Colour	Browm
Taste	Sweet and slightly bitter
Flavour	pleasent
Shape	
Consistency	solid
Shelf-life study [1 week]	stable
pH	5.1

Table No. 5

Phytochemical Test of Candy:

Compound	Result
Carbohydrate	Present
Alkaloids	Present
Flavonoids	Present
Steroids	Present
Polyphenols	Present

Table No. 6

Parameter	Results
Friability	08%
Disintegration	8min
Hardness	12 kg/cm^2
Moisture Content	1.2%

VI. CONCLUSION

The formulation and evaluation of the herbal candy revealed its potential as a supplementary therapy for dengue fever. These candies combine herbs that are known to have antiviral, anti-inflammatory, and immunomodulatory characteristics, making them a palatable and effective way to treat dengue symptoms. The candy's natural constituents, including papaya leaf extract, had excellent benefits in increasing platelet count. The use of these ingredients in the formulation provides a lower possibility of side effects when compared to conventional drugs. The study's findings indicate that this herbal candy could be an effective adjunct therapy for dengue patients, providing an efficient and pleasant approach to supplement traditional treatment.

REFERENCES

1. Vivek P. Chavda, Anup Kumar, Rittwika Banerjee, Nayan Das,
2. Shoyshob, T.Z.; Heya, I.A.; Afrin, N.; Enni, M.A.; Asha, I.J.; Moni, A.; Hannan, M.A.; Uddin, M.J. Protective Mechanisms of Carica papaya Leaf Extract and Its Bioactive Compounds Against Dengue: Insights and Prospects. Immuno 2024, 4, 629-645.
3. Masooma, Ariba Qaiser, Dr Sajid Ali, Dr Sobia Manzoor,Prospects of Carica papaya in the treatment of human viral infections: A comprehensive and a systematic review,Heliyon,Volume 10, Issue 21,2024,e39635,ISSN 2405-8444’
4. https://doi.org/10.1016/j.jep.2021.114074.(https://www.sciencedirect.com/science/article/pii/S0378874121003019) C. Nandini, SubbaRao V. Madhunapantula, Venugopal R. Bovilla, Mohammad Ali, K. Mruthunjaya, Manjula N. Santhepete, K. Jayashree, Platelet enhancement by Carica papaya L. leaf fractions in cyclophosphamide induced thrombocytopenic rats is due to elevated expression of CD110 receptor on megakaryocytes,Journal of Ethnopharmacology,Volume 275,2021,
5. Shubhransu Patro, Arushi Choudhary, Soumayan Mondal, Vibha Sharma, Chikkam Sandeep, Sailendra Nayak, Jyoti Prakash Sahoo, A Cross-Sectional Study Assessing the Clinical Traits of Patients With Dengue, Cureus, 10.7759/cureus.79182, (2025).
6. Rekha Kailey, Prasad Rasane, Jyoti Singh, Sawinder Kaur, Mahendra Gunjal, Jaspreet Kaur, Vishesh Bhadariya and Harshal Avinashe
7. Lokhande Prerana, M., Dawane Ravina, B., Deshmukh Gopal, S., Deshmukh Devanand, G., & Deshmukh Abhijeet, P. (2024). A BRIEF REVIEW ON: HERBAL CANDY.
8. Sanket Bhimrao Jadhav*1, Prof. S.A. Ghadage*2
Shukla, P., Bhise, S., & Gaikwad, B. (2018). Development of herbal candy using ginger essential oil. Journal of Postharvest Technology, 6(4), 106-115.
9. Vivek P. Chavda, Anup Kumar, Rittwika Banerjee, Nayan Das,Ayurvedic and Other Herbal Remedies for Dengue: An Update,Clinical Complementary Medicine and Pharmacology,Volume 2, Issue 3,2022,100024,ISSN 2772-3712,

10. Jiao, M., Liu, C., Prieto, M. A., Lu, X., Wu, W., Sun, J., … Li, N. (2022). Biological Functions and Utilization of Different Part of the Papaya: A Review. Food Reviews International, 39(9), 6781–6804.
11. O'Connor O., Ou T.P., Aubry F., Dabo S., Russet S., Girault D., In S., Minier M., Hoem T., Boyer S., et al. Potential role of vector-mediated natural selection in dengue virus genotype/lineage replacements in two epidemiologically contrasted settings. Emerg. Microbes Infect. 2021;10:1346–1357.
12. Urcuqui-Inchima S., Patiño C., Torres S., Haenni A.-L., Díaz F.J. Recent Developments in Understanding Dengue Virus Replication. Adv. Virus Res. 2010;77:1–39.
13. Nanaware N, Banerjee A, Mullick Bagchi S, Bagchi P, Mukherjee A. Dengue Virus Infection: A Tale of Viral Exploitations and Host Responses. Viruses. 2021 Sep 30;13(10):1967.
14. Yacoub S, Wills B, 2015. Dengue: an update for clinicians working in non-endemic areas. Clin Med (Lond) 15: 82–85. [DOI] [PMC free article] [PubMed] [Google Scholar]
15. Khosavanna RR, Kareko BW, Brady AC, Booty BL, Nix CD, Lyski ZL, Curlin ME, Messer WB. Clinical Symptoms of Dengue Infection among Patients from a Non-Endemic Area and Potential for a Predictive Model: A Multiple Logistic Regression Analysis and Decision Tree. Am J Trop Med Hyg. 2021 Jan;104(1):121-129. doi: 10.4269/ajtmh.20-0192. PMID: 33200724; PMCID: PMC7790069.
16. Hooda, Reena. "Research and Reviews: Journal of Pharmacognosy and Phytochemistry." (2015).