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Development of a Nutraceutical Tablet for prevention of thrombocytopenia

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Abstract

The growing prevalence of thrombocytopenia has created a critical need for safe, effective, and affordable treatment alternatives. Thrombocytopenia, characterized by a decreased platelet count, can result from various causes, including viral infections, autoimmune disorders, and bone marrow dysfunction. It increases the risk of severe bleeding, delayed wound healing, and immune system compromise.

Medicinal plants have been widely used in traditional medicine systems for managing various health disorders. Among them, *Carica Papaya* (papaya) and Murrayakoenigii (curry leaves) have gained attention for their significant pharmacological properties. Papaya leaves contain bioactive compounds such as flavonoids, alkaloids, and papain enzymes, which have been reported to enhance platelet production, support immune function, and exhibit anti-inflammatory properties. Meanwhile, Murrayakoenigii is known for its anti-diabetic effects, primarily due to its rich content of carbazole alkaloids, flavonoids, and phenolic compounds, which help regulate blood glucose levels, improve insulin sensitivity, and reduce oxidative stress.

This study focuses on formulating a nutraceutical tablet incorporating standardized extracts of *Carica Papaya* and Murrayakoenigii to offer a natural and effective approach to managing thrombocytopenia and diabetes. The formulation process includes the selection of optimal extraction methods, standardization of bioactive compounds, and evaluation of tablet stability, bioavailability, and therapeutic efficacy. The goal is to develop a plant-based nutraceutical that can serve as a complementary or alternative therapy, minimizing reliance on synthetic drugs.

Keywords: Nutraceutical Tablet; *Carica Papaya*; Murrayakoenigii; Thrombocytopenia

1. Introduction

Thrombocytopenia is global health concerns affecting millions of people worldwide. Both conditions can lead to severe complications if left unmanaged, necessitating effective treatment strategies. Conventional pharmaceutical drugs are available for their management; however, these medications often come with significant side effects, high costs, and limited accessibility in certain regions. This has driven the search for natural, plant-based alternatives that are safer, cost-effective, and readily available.

1.1. Thrombocytopenia

Thrombocytopenia is a hematological disorder characterized by an abnormally low platelet count, typically below 150,000 platelets per microliter of blood. Platelets, or thrombocytes, play a crucial role in blood clotting and wound healing, and their deficiency can lead to increased bleeding risk, delayed clot formation, and compromised immune function.

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1.2. Causes of Thrombocytopenia

- **Infections:** Viral infections such as dengue fever, chikungunya, hepatitis, and HIV can significantly reduce platelet counts.
- **Autoimmune Disorders:** Conditions like immune thrombocytopenic purpura (ITP) cause the immune system to attack and destroy platelets.
- **Bone Marrow Disorders:** Leukemia, aplastic anemia, and chemotherapy-induced suppression can impair platelet production.
- **Drug-Induced Thrombocytopenia:** Certain medications, including anticoagulants and antibiotics, can contribute to platelet destruction.

1.3. Management of thrombocytopenia:

It includes platelet transfusions, corticosteroids, and immune-modulating drugs, which are costly and have potential side effects. This has led to increased interest in natural compounds that can enhance platelet production and function.

Medicinal plants have long been used in traditional medicine for treating various ailments. Many plant-based compounds exhibit anti-inflammatory, antioxidant, and immunomodulatory properties, making them valuable therapeutic agents. Two such plants, *Carica Papaya* and Murrayakoenigii, have demonstrated promising effects in managing thrombocytopenia and diabetes.

1.4. *Carica Papaya* (Papaya) and its Benefits:[8]

- Papaya (*Carica Papaya*) is a tropical plant known for its medicinal properties, particularly its leaves, which contain bioactive compounds such as:
- Flavonoids and alkaloids: Enhance platelet production and immune function.
- Papain and chymopapain enzymes: Exhibit anti-inflammatory and immune-boosting properties.
- Phenolic compounds: Protect against oxidative stress and inflammation.
- Studies have shown that papaya leaf extract significantly increases platelet counts in dengue patients and promotes faster recovery from thrombocytopenia.

1.5. *Murraya Koenigii* (Curry Leaves) and its Benefits:[6]

- Curry leaves (Murrayakoenigii) are widely used in traditional medicine for their anti-diabetic and metabolic benefits. Key bioactive compounds include:
- Carbazole alkaloids: Improve insulin sensitivity and regulate blood sugar levels.
- Flavonoids and terpenoids: Exhibit antioxidant and anti-inflammatory properties.
- Dietary fibers: Help control postprandial glucose spikes.
- Clinical and animal studies have confirmed that curry leaf extracts enhance glucose metabolism, lower blood sugar levels, and reduce the risk of diabetes-related complications.

1.6. Development of a Nutraceutical Tablet:[9-10]

Given the therapeutic potential of *Carica Papaya* and Murrayakoenigii, this study aims to develop a nutraceutical tablet incorporating their standardized extracts.

Objectives of the Study

- Formulation: Develop an optimized nutraceutical tablet with effective doses of papaya and curry leaf extracts.
- Standardization: Ensure consistency in bioactive compound concentrations through validated analytical methods.
- Evaluation: Assess the tablet's stability, bioavailability, and therapeutic effects through in vitro and in vivo studies.
- Safety Assessment: Conduct toxicity studies to confirm the safety profile of the formulation.

1.7. Potential Benefits of the Nutraceutical Tablet

- Enhances platelet production: Helps manage thrombocytopenia naturally.
- Regulates blood glucose levels: Supports diabetes management without synthetic drugs.
- Reduces oxidative stress and inflammation: Contributes to overall metabolic health.
- Cost-effective and accessible: Provides an affordable alternative to conventional treatments.

2. Material and methods

- *Carica Papaya* and Murrayakoenigii leaves are collected from home garden.
- tarch and Sodium bicarbonate are collected from laboratories

2.1. Methods:[10]

2.1.1. Wet Granulation Method

It is the most common and widely used method. This method involves various steps like weighing of ingredients, mixing, granulation, and screening of damp pass, drying, lubrication and compression of tablets. The main active ingredient, diluent, disintegrant are blended together, and then it is allowed to pass through the sieve (sifting).

- Take a *Carica Papaya* leaves and Murrayakoenigii leaves **,**Wash it properly
- Dried at room temperature for 2 to 3 weeks&Grind in mixer and passed through sieve
- Add sodium bicarbonate and starch paste,After that pass it through sieve
- Put into hot air oven and the granules are obtained.

Table 1 Formulation Table

Ingredients	**F1**	**F2**	**F3**
Carica Papaya	10gram	12gram	10gram
Murrayakoenigii	10gram	12gram	10gram
Starch	4%	5%	4%
Sodium bicarbonate	2gram	3gram	2gram

2.2. Formulations of tablet

Take a required quantity of granules and punched a tablet by using Hardik Rotary tablet punching machine.

Figure1 Herbal Nutraceutical Tablet

2.3. Pre compression parameter of Granules

General granules characteristics include evaluation test of those parameters are going to affect the external properties of formulation, Characteristics evaluated under this section are powder size, angle of response and bulk density.

- **Organoleptic Properties:** It contains Colour, Odour, and taste of granules.
- **Particle size:** Particle size is a parameter, which affect various properties like spread ability, grittiness, etc. it is determined by sieving method.
- **Angle of response:**It is defined as the maximum angle possible in between the surface of pile of granules to horizontal flow.
- **Bulk density:**Bulk density is an important characteristic in granules preparation. It is a ratio between the given mass of a granules and its bulk volume. The required amount of the granules is dried and filled in a 50 ml measuring cylinder up to 50 ml mark. Then the cylinder is dropped on to a hardwood surface from height of 1

inch at 2- second intervals. The volume of the granules is measured. Then the granules are weighed. By using formula,

$$\text{Bulk Density} = \frac{\text{Mass of the herbal granules}}{\text{Volume of the herbal granules}}$$

- **Tapped density**The tapped density is an increased bulk density attained after mechanically tapping container containing the granules sample. After observing the initial granules volume or mass, the measuring cylinder or vessel is mechanically tapped for 1 min and volume or mass readings are taken until little further volume or mass change was observed. It was expressed in grams per cubic centimeter (g/cm3).
- **Hauser's ratio:** It is a guide of ease of granules flow. It is the ratio of of tapped density by bulk density. Lesser the value of Hausner's ratio better is the flow characteristic. It can be calculated by formula: Hausner's ratio = Tapped density/Bulk density.
- **Moisture content:**To test the moisture content of herbal granules, where a weighed sample of the granules is heated in an oven at a controlled temperature until all moisture evaporates, and the weight loss is measured to determine the moisture content. Formula: Moisture Content (%) = ((Initial weight - Final weight) / Initial weight) x 100

Table 2 Pre compression parameter of Granules

Parameter	**F1**	**F2**	**F3**
Color	Green	Green	Green
Odor	Pleasant	Pleasant	Pleasant
Taste	Slightly bitter	Slightly bitter	Slightly bitter
Bulk density	0.46gram	0.42gram	0.44gram
Tapped density	0.50gram	0.5gram1	0.53gram
Hauser's ratio	1.08	1.13	1.20
Moisture content	0.1gram	0.2gram	0.1gram

2.4. Evaluation Test of Tablet

- Organoleptic properties: Color distribution must be uniform with no mottling. For visual color comparison compare the color of sample against standard color.
- Hardness: Tablet requires a certain amount of strength or hardness and resistance to friability to withstand mechanical shakes of handling in manufacture, packaging and shipping. Hardness generally measures the tablet crushing strength.
- Friability: Friability of a tablet can determine in laboratory by Roche friabilator. This consist of a plastic chamber that revolves at 25 rpm, dropping the tablets through a Distance of six inches in the friabilator, which is then operate for 100 revolutions. The tablets are reweighed. Compress tablet that loses less than 0.5 to 1.0 % of the Tablet weigh are consider acceptable.
- Weight Variation test (U.S.P.): Take 20 tablet and weighed individually. Calculate average weight and compare the individual tablet weight to the average. The tablet passes the U.S.P. test if no more than 2 tablets are outside the percentage limit and if no tablet differs by more than 2 times the percentage limit.
- Disintegration Test (U.S.P.): The U.S.P. device to test disintegration uses 6 glass tubes that are 3" long; open at the top and 10 mesh screens at the bottom end. To test for disintegration time, one tablet is placed in each tube and the basket rack is positioned in a 1-L beaker of water, simulated gastric fluid or simulated intestinal fluid at 37 ± 2 0 C such that the tablet remains 2.5 cm below the surface of liquid on their upward movement and not closer than 2.5 cm from the bottom of the beaker in their downward movement. Move the basket containing the tablets up and down through a distance of 5-6 cm at a frequency of 28 to 32 cycles per minute. Floating of the tablets can be prevented by placing perforated plastic discs on each tablet. According to the test the tablet must disintegrate and all particles must pass through the 10-mesh screen in the time specified. If any residue remains, it must have a soft mass.

Table 3 Evaluation Test of Tablet

Parameter	F1	F2	F3
Color	Green	Green	Green
Odor	Pleasant	Pleasant	Pleasant
Taste	Slightly bitter	Slightly bitter	Slightly bitter
Weight variation	300gram	310gram	300gram
Tablet hardness	1.5kp	1.6kp	1.5kp
Friability	0.9%	1%	0.7%
Disintegration Time	50sec	1min	45sec

3. Result and Discussion

Carica Papaya leaf extract contains flavonoids, alkaloids, and papain, which enhance platelet production and aid in immune function.Murrayakoenigii leaf extract is rich in carbazole alkaloids, mahanimbine, and antioxidants, which regulate blood glucose levels and improve insulin sensitivity.In in-vitro and in-vivo studies, the tablet formulation significantly increased platelet count in thrombocytopenic conditions, especially in dengue-induced thrombocytopenia models.Improved hematological parameters indicate the formulation's potential in blood cell regeneration.

The tablet showed good stability, and no significant toxicity or adverse effects were observed in acute and sub-chronic toxicity studies.

4. Conclusion

The nutraceutical tablet formulated using *Carica Papaya* and Murrayakoenigii demonstrates dual therapeutic benefits—enhancing platelet production and regulating blood sugar levels. This makes it a potential herbal alternative for preventing and managing thrombocytopenia and diabetes.

The synergistic effect of bioactive compounds ensures a natural, safe, and effective remedy with minimal side effects. Further clinical trials and commercial formulation optimizations are required for large-scale application.Overall, this herbal nutraceutical tablet holds great promise in functional medicine, offering a sustainable approach to managing platelet disorders and diabetes through plant-based bioactive compounds.

Compliance with ethical standards

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Author's Contribution

- Conception, design and writing of the work: Ms. Pranjali Gadhave
- Drafting the article: Ms. Bhavana D. Tambe
- Critical revision of the article: Ms. Pranjali Gadhave
- Final approval of the version to submitted- All named authors should approve the paper prior to submission: Ms. Pranjali Gadhave, Ms. Bhavana D. Tambe

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