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FORMULATION AND EVALUATION OF HERBAL EFFERVESCENT FLOATING TABLET BY USING SYZEGIUM CUMIN (JAMUN SEEDS EXTRACT) USED IN TREATMENT OF DIABETES.

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ABSTRACT

The present study aimed at developing effervescent floating tablets incorporating ethanolic seed extract of Syzygium cumini (Jamun) for the sustained management of diabetes mellitus. A gastroretentive floating drug delivery system (GRDDS) was designed to enhance the residence time of the extract in the stomach and upper gastrointestinal tract, thereby prolonging hypoglycemic activity. (Jamun) for the sustained management of diabetes mellitus.Jamun (Syzygium cumini) seeds have been widely recognized in traditional medicine for their potential to support diabetes management. They contain phytochemicals such as gallic acid, ellagic acid, quercetin, and kaempferol, which contribute to blood glucose regulation, enzyme inhibition, and antioxidant activity. Formulation of Jamun seed extracts into standardized tablets provides a convenient dosage form that improves stability, accuracy, and patient compliance. Experimental studies indicate that these tablets can lower fasting blood glucose, enhance insulin sensitivity, and protect against oxidative stress. Clinical findings further suggest their ability to improve long-term glycemic control. This review discusses the phytochemistry,mechanisms of action, formulation techniques, evaluation methods, and

clinical perspectives of Jamun seed tablets, highlighting their potential role as natural diabetic agents.

KEYWORDS: Antidiabetic, Flavonoid, phenolic, polyphenol, hypoglycemic.

INTRODUCTION

Approximately 80% of people worldwide use herbal medicine for their primary medical care, according to the World Health Organization. Herbal medicines are now widely accepted. One kind of controlled drug delivery system is floating drug delivery, which can target the drug's administration to a particular location, extend the length of therapeutic activity, and regulate the rate of drug delivery. Because the tablet's floating drug delivery mechanism has a lower bulk density than gastric fluid, it stays buoyant in the stomach and releases the medication gradually in the upper gastrointestinal tract for both local and systemic effects without significantly slowing down the rate of gastric emptying. The effervescent tablet contains swellable and effervescent ingredients that, once in the stomach, release carbon dioxide and cause the formulation to float. Floating pills increase bioavailability, extend the duration of a medication's gastric residence, and make local drug administration to the stomach easier. An imbalance between the production of gastric acid and the preservation of the protective mucosal barrier which depends on the release of prostaglandins, bicarbonate, and mucosal growth factors causes ulcers.[1] Diabetes has become one of the fastest-growing health concerns globally, impacting people of all ages and regions. It is characterized by consistently elevated blood sugar levels, usually caused by either inadequate insulin production or the body’s reduced ability to utilize insulin properly. This metabolic disorder greatly increases the likelihood of severe health complications such as heart disease, kidney problems, nerve damage, and others. Moreover, it imposes a significant economic burden on both individuals and healthcare systems. While medical advancements have enhanced diabetes treatment, several challenges persist due to its chronic nature, potential side effects of medications, and rising costs of care. Consequently, there is increasing interest in natural and holistic approaches that are safer, more cost-effective, and widely accessible.[2]

PHARMACOLOGY OF JAMUN (SYZYGIUM CUMINI) SEED

1. Plant profile of jamun seeds

Botanical Name: Syzygium cumini (L.) Skeels

Common Name: Jamun, Java plum, Black plum, Indian blackberry

Synonyms: Eugenia jambolana, Syzygium jambolanum

Family: Myrtaceae.

2. Taxonomic classification

Kingdom: Plantae

Phylum: Angiosperms

Order: Myrtales

Family: Myrtaceae

Genus: Syzygium

Species: Syzygium cumini (L.) Skeels

ADVANTAGES OF JAMUN SEEDS[3]

1.Blood Pressure Maintenance

- The antioxidants present in jamun seed powder, particularly ellagic acid, contribute to the management of hypertension and support the maintenance of normal blood pressure levels**.**

2. Digestive Health Promotion

- The dietary fiber present in jamun seed powder supports digestive function and may aid in the management of gastrointestinal disorders, including ulcers and inflammation.

3. Weight Loss Support

- The high fiber content promotes satiety, thereby contributing to weight management and supporting weight loss.

4. Skin Health Improvement

- Jamun seed powder is rich in vitamins A and C as well as antioxidants, which help in maintaining clear and glowing skin.

Pre-Formulation Parameters[2,3]

Bulk density

Bulk density is expressed as the mass of a powder sample divided by the total volume it occupies.

Bulk density=Mass/Bulk volume

Tapped density

Tapped density is expressed as the mass of a powder sample divided by the volume it occupies following tapping for a defined duration**.**

Tapped density=Mass/Volume

Angle repose

The powder was carefully poured through a funnel that was fixed in such a way that its lower tip was positioned 2 cm above the surface of the graph paper. The pouring was continued until the apex of the powder heap just touched the tip of the funnel. The angle of repose was then determined using the following formula.

θ = Angle of repose

h = Height of the pile

r = Mean radius of the base of the pile.

Carr's index

Carr's index determines the compressibility of a powder by relating its bulk density to its tapped density.

Carr's Index = (Tapped Density – Bulk Density) / Tapped Density × 100

Post-Compression Parameters

Diameter and thikness

Tablet diameter and thickness were determined using a Vernier caliper. The thickness of the tablets is influenced by the die diameter. A total of ten tablets from each batch were randomly selected, and the mean values were calculated.

Hardness test

Tablet hardness was evaluated using a Monsanto hardness tester for ten tablets, and the mean value was determined.

Friability

A Roche friabilator was used to test the tablets' friability. 20 tablets were used for friability; the time was set at 4 minutes, and the speed was set at 25 rpm.

Morphological Characteristics[4]

Tree

- A medium to large evergreen tree that typically reaches a height of 10 to 30 meters.

- The bark is smooth and greyish with a reddish tint in young stages, gradually becoming fissured as the tree matures.
- The tree has wide-spreading branches that form a rounded canopy.

Figure 1: Tree.

Leaves

- Leaves are simple, lance-shaped to elliptical in form, typically measuring 10–25 cm in length and 3–6 cm in width.
- The upper surface is dark green, while the underside is pale green and exhibits slight hairiness.
- The leaves are arranged oppositely along the branches, with margins that are smooth or slightly wavy.

Figure 2: Leaves.

Flowers

- Small white or pale pink flowers arranged in dense panicle clusters enhance pollination efficiency and attract insects.
- Each flower measures approximately 1–1.5 cm in diameter and consists of five delicate petals.
- The flowers are mildly fragrant, helping attract pollinators such as bees.

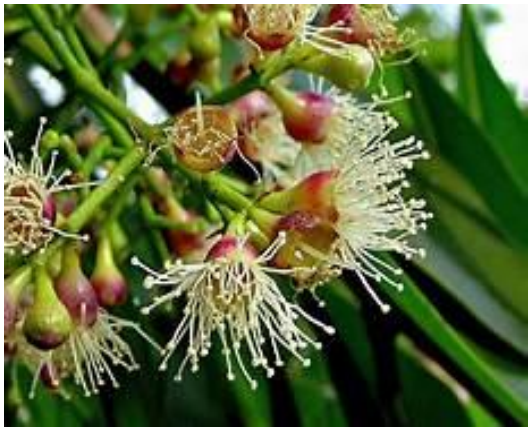


Figure 3: Flowers.

Fruits

- The structure is ovoid to elliptical in shape, measuring approximately 2–3 cm in length.
- Initially green, the structure ripens to a dark purple or black color upon maturity.
- The fruit has a sweet, slightly astringent flavor and contains a single large seed.

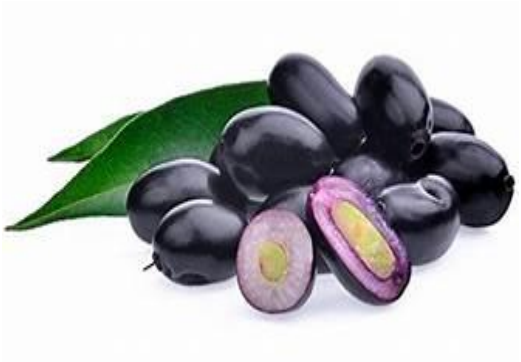


Figure 4: Fruits.

Roots

- The plant possesses a deep taproot with extensive lateral roots, enabling adaptation to diverse soil conditions.

Figure 5: Roots.

Bark and Stem

- **Bark:** Greyish-brown to dark brown in color, the bark is typically rough and becomes flaky with age.
- **Stem:** The tree has a thick, straight trunk and a wide crown that provides dense shade.

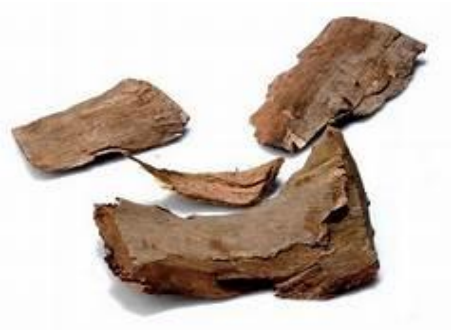


Figure 6: Bark.

MATERIALS AND METHOD

Table of Ingredients

Table 1: Ingredients.

SR.NO	INGREDIENTS	ROLE
1.	Jamun seed extract	Active ingredient
2.	Lactose	Binder
3.	Sodioum bicarbonate	Buffering agent
4.	Citric acid	Stabilizer
5.	Magnesium sterate	Lubricant
6.	Sucrose	Coating agent
7.	HPMC-E5	Film-forming agent
8.	PVPK-30	Solubility enhancer

METHODOLOGY

Trail 1:

Formulation Table

Table 2: Formulation Table.

SR.NO	INGREDENTS	QUANTITY(TABLET 50)
1.	Jamun seed extract	17.5gm
2.	Sodium alginate	3.4gm
3.	Sodium bicarbonate	2.5gm
4.	Citric acid	0.1gm
5.	Magnesium stearate	0.35gm
6.	Sucrose	0.4gm
7.	HPMC-E5	0.5gm
8.	PVPK -30	0.25gm

METHOD OF PREPARATION

1. Mix jamun seed extract with Sodium alginate .
2. then mix HPMC with above mixture.
3. Prepare solution of PVPK-30 with water.(1-2 ml)
4. Prepare solution sucrose.(1-2ml)
5. add this two solution into above dry mixture.
6. Then add sodium bicarbonate,citric acid,magnesium stearate and prepare damp mask.
7. this granules dried at room temperature and after drying completely take 500Mg graunles and prepare tablet.

OBSERVATION

First trail is failed due to sodium alginate that shows less binding property.

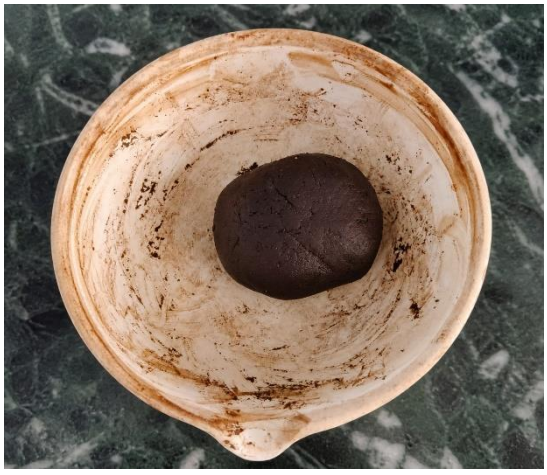


Figure 7: Damp mask.

Trail 2

Formulation Table

Table 3: Formulation Table.

SR.NO	INGREDENTS	QUANTITY(TABLE 50)
1.	Jamun seed extract	17.5gm
2.	Lactose	3.4gm
3.	Sodium bicarbonate	2.5gm
4.	Citric acid	0.1gm
5.	Magnesium stearate	0.35gm
6.	Sucrose	0.4gm
7.	HPMC-E5	0.5gm
8.	PVPK-30	0.20gm

METHOD OF PREPARATION

1. Mix jamun seed extract with lactose.
2. then mix HPMC with above mixture.
3. Prepare solution of PVPK-30 with water.(1-2 ml)
4. Prepare solution sucrose.(1-2ml)
5. add this two solution into above dry mixture.
6. Then add sodium bicarbonate,citric acid,magnesium stearate and prepare damp mask.
7. this granules dried at room temperature and after drying completely take 500Mg graunles and prepare tablet.

OBSERVATION

Second trial was failed because of taking less amount of PVPK-30 which decrease solubility.

Figure 8: Jamun seed tablet (Damage tablet).

TRAIL 3

Formulation Table

Table 4: Formulation Table.

SR.NO	INGREDENTS	QUANTITY(TABLE 50)
1.	Jamun seed extract	17.5gm
2.	Lactose	3.4gm
3.	Sodium bicarbonate	2.5gm
4.	Citric acid	0.1gm
5.	Magnesium stearate	0.35gm
6.	Sucrose	0.4gm
7.	HPMC-E5	0.5gm
8.	PVPK-30	0.25gm

METHOD OF PREPARATION

1. Mix jamun seed extract with Lactose .
2. then mix HPMC with above mixture.
3. Prepare solution of PVPK-30 with water.(1-2 ml)
4. Prepare solution sucrose.(1-2ml)
5. add this two solution into above dry mixture.
6. Then add sodium bicarbonate,citric acid,magnesium stearate and prepare damp mask.
7. this granules dried at room temperature and after drying completely take 500Mg graunles and prepare tablet.

Figure 9: Damp mask.

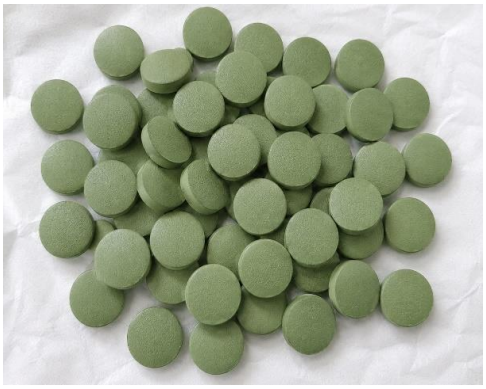


Figure 10: Jamun seed tablet.

OBSERVATION

Due to better result of this trial we decided to finalize this formula for preparation of tablet.

Evaluation Parameters

1. Organoleptic Evaluation

Parameter	Observation
Color	Dark brown
Odor	Characteristic aromatic odor
Taste	Slightly bitter and astringent
Shape	Circular
Surface texture	Smooth
Appearance	Uniform and elegant

RESULT

The prepared herbal floating tablets showed acceptable organoleptic characteristics with uniform appearance and good elegance.

2. Weight Variation Test

Procedure

Twenty tablets were selected randomly and individually weighed using a digital balance. The average weight was calculated and compared with pharmacopeial limits.

Tablet No.	Weight (mg)
1	498
2	502
3	500

RESULT

Average weight = 500 ± 3 mg

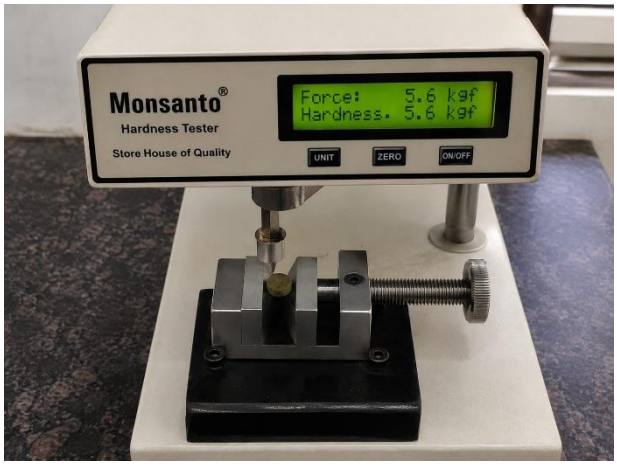
Pharmacopoeial limit = ±5%

RESULT

All tablets were within the official pharmacopoeial weight variation limits, indicating uniform die filling during compression.

3. Hardness Test

Procedure



Tablet hardness was measured using Monsanto hardness tester.

Formulation	Hardness (kg/cm²)
F1	2.8 ± 0.1
F2	3.0 ± 0.2
F3	3.1 ± 0.1

RESULT

The tablets exhibited satisfactory hardness, ensuring adequate mechanical strength and resistance during handling and transportation.

4. Thickness Test

Procedure

Tablet thickness was measured using Vernier calipers.

Formulation	Thickness (mm)
F1	3.92 ± 0.03
F2	3.96 ± 0.04
F3	4.01 ± 0.05

RESULT

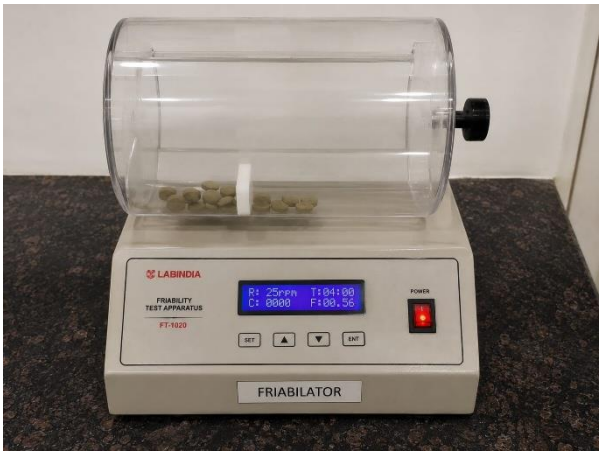
The tablets showed uniform thickness indicating proper compression and consistent tablet size.

5. Friability Test

Procedure

Twenty tablets were weighed and rotated in Roche friabilator at 25 rpm for 4 minutes.

Formulation	Friability (%)
F1	0.71
F2	0.65
F3	0.60



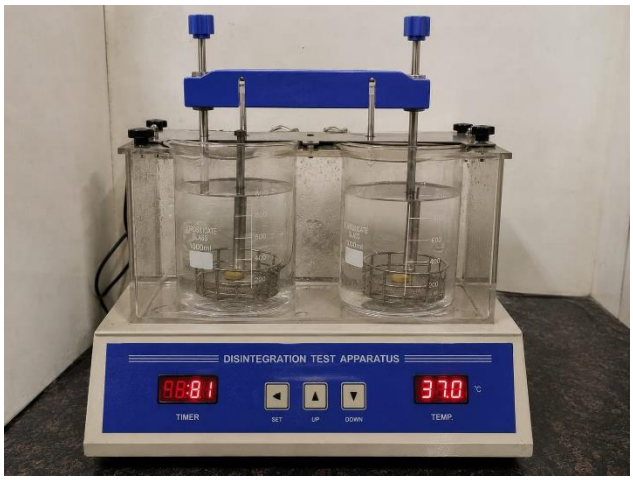
RESULT

Friability values were below 1%, indicating good mechanical resistance of tablets.

6. Disintegration Test

Procedure

Disintegration test was performed using USP disintegration apparatus in 0.1N HCl maintained at 37 ± 0.5°C.



Formulation	Disintegration Time
F1	18 min
F2	20 min
F3	23 min

RESULT

The increase in polymer concentration prolonged the disintegration time, supporting sustained drug release behavior.

7. Stability Study

Procedure

Optimized formulation (F2) was stored according to ICH guidelines at:

40°C ± 2°C, 75% RH ± 5% for 3 months.

Parameter	Initial	After 3 Months
Color	Dark brown	No change
Hardness	3.4 kg/cm²	3.3 kg/cm²
Friability	0.52%	0.55%
Drug content	98.45%	97.88%
Floating lag time	92 sec	95 sec
Total floating time	>12 hr	>12 hr

RESULT

No significant changes were observed during stability studies, confirming good stability of the herbal floating tablet formulation.

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