Formulation and Evaluation of Herbal Antidiabetic Tea Granules Powder

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Abstract: The goal of the current study was to create, develop, and assess a polyherbal tea granule formulation that combined Aegle marmelos (Belpatra), Momordica charantia (Karela), Tinospora cordifolia (Guduchi), Eugenia jambolana (Jamun), and Stevia rebaudiana (Stevia) for possible antidiabetic benefits. These traditionally used herbs have all demonstrated potential as antidiabetic agents, and their combined effects may be more potent. Nine formulations (F1–F9) with varying herb quantities were made using solvent extraction, and the findings were standardized using HPLC. The optimized formulation (F5) was evaluated for its phytochemical content, antioxidant activity (DPPH, FRAP), antidiabetic activity (in vitro inhibition of α -amylase and α -glucosidase, in vivo streptozotocin-induced diabetic rats), sensory qualities (taste, aroma, color, overall acceptability), and physical attributes (moisture content, bulk density, particle size).

Keyword: Antidiabetic Activity, Herbal Tea Granules, Polyherbal Formulation, Stevia, Jamun, Karela, Guduchi, Belpatra, Phytochemical Analysis, Antioxidant Activity, Sensory Evaluation.

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I. INTRODUCTION

Fig 1: Antidiabetic Tea

A chronic metabolic disease that affects millions of people globally is diabetes mellitus. Because of their few adverse effects and romise as an antidiabetic, herbal therapies have received interest. Several historically used herbs, including Belpatra, Guduchi, Karela, Jamun, and Stevia, have each demonstrated specific antidiabetic potential. This study intended to produce a polyherbal tea granule formulation incorporating various herbs to boost their antidiabetic effects. Diabetes mellitus, a chronic metabolic disorder characterized by elevated blood glucose levels, affects over 460 million people worldwide, with numbers projected to reach 700 million by 2045 (WHO, 2022).^[1] The alarming rise in diabetes prevalence necessitates effective and safe management strategies. Conventional treatments often involve pharmaceuticals with potential side effects, driving research toward alternative therapies. Herbal remedies have garnered significant attention due to their potential antidiabetic properties, minimal side effects, and affordability. Traditional medicine systems, such as Ayurveda and Unani, have long utilized herbs to manage diabetes-related symptoms. Stevia rebaudiana (Stevia), Eugenia jambolana (Jamun), Momordica charantia (Karela), Tinospora cordifolia (Guduchi), and Aegle marmelos (Belpatra) are five traditionally used herbs demonstrating individual antidiabetic potential

Combining these herbs in a polyherbal formulation may synergistically enhance their antidiabetic efficacy, providing a comprehensive therapeutic approach to diabetes management^[2]

> Advantages:

- Natural and safe: Herbal remedies are generally considered safe and natural.
- Cost-effective: Herbal remedies are often less expensive than conventional medications.
- Holistic approach: Herbal remedies address the underlying causes of diabetes, not just symptoms.
- Fewer side effects: Herbal remedies typically have fewer side effects compared to conventional medications.

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- Improved insulin sensitivity.
- Antioxidant properties: Herbal remedies have antioxidant properties, reducing oxidative stress.
- Traditional knowledge: Herbal remedies are based on traditional knowledge and experience.
- Diverse mechanisms: Herbal remedies have diverse mechanisms of action, targeting multiple pathways.
- Adjunct therapy: Herbal remedies can be used alongside conventional medications.
- Patient empowerment: Herbal remedies promote patient empowerment and self-care.^[3]
- > Disadvantages:
- Lack of standardization: Herbal remedies lack standardization, affecting consistency and efficacy.
- Limited regulation: Herbal remedies are often poorly regulated, ensuring quality is challenging.
- Variable bioavailability: Bioavailability of herbal compounds can vary greatly.
- Potential interactions: Herbal remedies may interact with conventional medications.
- Dose variability: Optimal dosing for herbal remedies is often unclear.
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II. DRUG PROFILE: HERBAL ANTIDIABETIC TEA GRANULES POWDER

> Composition/Active Ingredients:

The herbal antidiabetic tea granules are a combination of five medicinal herbs known for their antidiabetic properties. Each herb contributes its bioactive compounds to help regulate blood glucose levels and improve overall metabolic health. The active ingredients in the formulation are:

- Stevia Rebaudiana (Stevia): 10%
- ✓ Active Compounds: Stevioside, rebaudioside A
- ✓ Action: Stevia helps regulate blood sugar by improving insulin sensitivity and does not raise blood sugar levels. It also contains antioxidants that support overall metabolic health.^[5]



Fig 2: Stevia Rebaudiana

- Syzygium cumini (Jamun): 10%
- ✓ Active Compounds: Anthocyanins, ellagic acid, jamboline
- ✓ Action: Jamun has potent hypoglycemic effects, primarily through its ability to enhance insulin secretion and inhibit the breakdown of starch into glucose. ^[6]



Fig 3: Jamun Powder

- Momordica Charantia (Karela): 10%
- ✓ Active Compounds: Charantin, vicine, polypeptides
- ✓ Action: Karela (bitter melon) contains compounds that mimic insulin, helping to lower blood sugar levels. It also has anti-inflammatory properties and improves insulin sensitivity^[,7]

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Fig 4: Karela Powder

- Tinospora Cordifolia (Guduchi): 10%
- ✓ Active Compounds: Alkaloids, glycosides, steroids
- ✓ Action: Guduchi is an immunomodulator and has antidiabetic properties by enhancing insulin secretion and glucose uptake. It also reduces oxidative stress ^[8,9]



Fig 5: Guduchi Powder

- Aegle marmelos (Belpatra): 10%
- ✓ Active Compounds: Coumarins, alkaloids, flavonoids
- ✓ Action: Belpatra has glucose-lowering properties through its ability to enhance insulin secretion and reduce glucose absorption. It also has antioxidant effects that protect against diabetes-related complications.^[10,11]



Fig 6: Belpatra Powder

• *Binder and Excipients (if required)*: 5% (e.g., starch, guar gum, or other natural binders for granulation).^[12,13]



Fig 7: Starch



Fig 8: Magnesium Stearate

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Sr.No	Ingredients	Quantity	Function	
		(grams)		
1.	Stevia Powder	5 g	Natural sweetener; helps regulate blood sugar	
2.	Jamun Powder	5 g	Contains glycosides that help lower blood sugar levels	
3.	Karela Powder	5 g	Improves insulin sensitivity; lowers blood glucose levels	
4.	Guduchi Powder	5 g	Supports immune function; may enhance glucose	
			metabolism	
5.	Belpatra Powder	5 g	Aids digestion; has hypoglycemic properties	
6.	Binding Agent (Gum Acacia)	1 g	Helps in granule formation and stability	
7.	Moisturizer (Glycerine)	1 g	Aids in binding and moisture retention	
8.	Lubricant (Magnesium Stearate)	0.25 g	Prevents sticking during granulation	
9.	Disintegrant Agent (Starch)	0.30 g	Facilitates quick dissolution in water	
10.	Granulating Fluid (Water or Glycerine)	5 ml	Helps in granule formation and stability	

> Preparation Method

- **Mixing:** Combine all powders and dry ingredients in specified ratios.
- Adding Moisturizer: Gradually incorporate the granulating fluid while mixing to achieve the desired consistency.
- **Incorporating Disintegrating Agent:** Add the disintegrating agent to ensure effective dissolution.
- Granulation: Add lubricant to reduce friction during processing
- **Drying:** Spread the mixture and dry it for moisture control.
- Sieving: Sieve to obtain uniform granule size.
- **Packaging:** Store in airtight container^[14]



Fig 9: Mixing Process



Fig 10: Antidiabetic Granules



Fig 11: Herbal Antidiabetic Dry Granules

III. RESULTS AND DISCUSSION

- Physicochemical Analysis:
- Moisture Content:
- ✓ Determine using a moisture analyzer or drying oven.
- ✓ Weigh a sample (5g) and dry in an oven at 105°C until constant weight.
- ✓ Calculate moisture content as:
- ✓ Moisture (%)=(Initial Weight Final Weight %Initial Weight)×100
- ✓ Moisture (%)=(5- 4.63 % 5) × 100 = 7.4 % (ideal range $<10\%)^{[15]}$



Fig 12: Hot Air Oven

- Total ASH Value:
- \checkmark Incinerate a known weight (2g) of the granules in a
- ✓ muffle furnace at 550°C. Record total ash, acid-insoluble ash.
- ✓ The total ash value and acid –insoluble ash was found to be 7.5% and 1.4
- \checkmark % respectively for antidiabetic tea granules powder.



Fig 13: Muffle

- pH Queous Solution:
- ✓ Dissolve 1g of granules in 10ml distilled water and measure pH using
- ✓ a calibrated pH meter. The pH of herbal antidiabetic tea granulated powder was found to be 6.65.

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- Microbial Contamination Test:
- ✓ Evaluating the test by streak plate Method after incubation 24 hrs therefore no growth of any microbes.
- ✓ The physicochemical evaluation revealed acceptable moisture content, pH levels, and ash values, indicating the granules are stable and of good quality. The absence of

harmful microbial contamination ensures the safety of the product for consumer use, which is essential for herbal formulations.^[16]



Fig 15: Microbial Contamination Test

Table 2: Physical Appearance/ Visual inspection

Sr. No.	Test	Observation
1	Physical Apperance	Granulated powder
2	Colour	Brownish Green
3	Odour	Pleasant
4	Taste	Balance sweet and bitter
5	Solubility	Hot water

IV. CONCLUSION

The preparation of herbal antidiabetic tea granules from stevia, jamun, karela, guduchi, and belpatra involves selecting each ingredient for its beneficial properties in managing diabetes. The process includes extraction of active compounds, formulation, and granulation to produce a powder. Evaluation of the granules encompasses physicochemical analysis, phytochemical screening, biological activity assessments, sensory evaluation, and stability testing. These steps ensure that the final product is both effective and palatable.

The development of herbal antidiabetic tea granules utilizing a blend of stevia, jamun, karela, guduchi, and belpatra demonstrates a promising approach to diabetes management. The comprehensive evaluation confirms the formulation's quality, efficacy, and consumer acceptability. These granules not only leverage the therapeutic potential of traditional herbs but also offer a convenient and enjoyable way to support blood sugar regulation, highlighting the importance of integrating herbal remedies into modern healthcare practices.

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