

Formulation and Evaluation of Polyherbal Tablet Use in the Treatment of Antidiabetic / Diabetes Disease

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Abstract-- Diabetes mellitus is a long-term metabolic condition characterized by elevated blood glucose levels due to impaired insulin production, reduced insulin effectiveness, or both. The growing global incidence of diabetes has increased the demand for safe, cost-effective, and efficient treatment options. Herbal medicines, particularly polyherbal formulations, have attracted considerable interest because of their synergistic effects, lower risk of side effects, and enhanced therapeutic benefits. This study aimed to formulate and evaluate a polyherbal tablet for the management of diabetes mellitus. The formulation incorporated selected medicinal herbs recognized for their antidiabetic, antioxidant, and insulin-enhancing properties. Herbal extracts were mixed with appropriate pharmaceutical excipients and compressed into tablets using the direct compression technique. The prepared tablets were assessed for various quality control parameters, including physical appearance, weight uniformity, hardness, friability, thickness, disintegration time, and content uniformity, following standard pharmacopoeial requirements. In addition, *in vitro* studies were conducted to evaluate the dissolution profile and antidiabetic potential of the formulation. The evaluation results indicated that the tablets met acceptable pharmaceutical standards and exhibited adequate mechanical strength along with satisfactory disintegration characteristics. The observed antidiabetic activity may be attributed to the combined action of multiple bioactive compounds present in the herbal ingredients. The findings suggest that the developed polyherbal tablet has potential as an effective and patient-friendly herbal dosage form for diabetes management. However, further preclinical and clinical studies are necessary to confirm its safety, efficacy, and long-term therapeutic value in diabetic patients.

Keywords-- Antidiabetic Potential, Herbal Drug Delivery, Medicinal Plants, Phytochemicals, Polyherbal Tablet, Type 2 Diabetes Mellitus

I. INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by elevated blood glucose levels caused by defects in insulin secretion, insulin action, or both.

It is one of the fastest growing health problems worldwide and affects people of all age groups. According to global health reports, the prevalence of diabetes is increasing rapidly due to unhealthy lifestyle, obesity, lack of physical activity, stress, and genetic factors. Long-term uncontrolled diabetes can lead to severe complications such as cardiovascular diseases, kidney failure, nerve damage, retinopathy, and delayed wound healing.

A polyherbal formulation is a combination of two or more medicinal herbs designed to provide enhanced therapeutic effectiveness compared to single herbal drugs. Polyherbal tablets offer several advantages such as accurate dosage, better patient compliance, easy administration, improved stability, and convenient transportation. The preparation of herbal tablets also helps in masking unpleasant taste and odor of herbal extracts.

The objective of the study is to develop a safe, effective, stable, and economical herbal tablet formulation with potential antidiabetic activity. The study also aims to scientifically validate the traditional use of medicinal plants in diabetes management and provide an alternative herbal therapy with reduced side effects. The present study focuses on the formulation and evaluation of a polyherbal tablet intended for the management of diabetes mellitus. The selected herbal extracts were subjected to phytochemical screening and formulated into tablets using suitable pharmaceutical excipients by direct compression method. The prepared tablets were evaluated for various pre-compression parameters such as angle of repose, bulk density, tapped density, Carr's index, and Hausner ratio, as well as post-compression parameters including hardness, friability, weight variation, thickness, and disintegration time.

II. LITERATURE REVIEW

TABLE I: SUMMARY OF LITERATURE DEVELOPMENTS

Sr. No.	Title	Journal Name, Year	Author	Description
1	“Formulation, Characterisation and Preclinical Evaluation of Antidiabetic Activity of Polyherbal Tablet”	<i>International Journal of Phytomedicine</i>	B Ray, B B Panda, P K Biswal	Study prepared and evaluated polyherbal tablets for antidiabetic activity using streptozotocin-induced diabetic mice. Tablets showed reduction in blood glucose level.
2	“Formulation and Evaluation of Polyherbal Capsules for Antidiabetic Activity”	<i>International Journal of Multidisciplinary Research and Studies</i>	Akanksha Sharma, Sourabh Jain, Karunakar Shukla	Research explained formulation of polyherbal capsules containing Neem, Guduchi, Karela and other herbs with antidiabetic potential.
3	“Antidiabetic Potentials of a Novel Polyherbal Preparation Formulated According to Principles of Siddha System of Medicine”	<i>Journal of Evidence-Based Complementary & Alternative Medicine</i>	Venkataraman Balaji et al.	Polyherbal formulation improved glucose tolerance, antioxidant activity and lipid profile in diabetic rats.
4	“Comparative Study of Six Antidiabetic Polyherbal Formulation for its Multimodal Approaches in Diabetes Management”	<i>Biotech</i>	Saptadipa Paul, Mala Majumdar	Comparative evaluation of six marketed polyherbal antidiabetic formulations and their mechanisms of action.
5	Synergistic and Safe Antidiabetic Effect of Polyherbal Formulation: Comprehensive Overview	<i>International Journal of Life Science and Pharma Research</i>	Vipinchandra Bhaskarrao Pande, Saket Singh Chandel	Review article describing synergistic effects and safety of polyherbal antidiabetic formulations.

III. MATERIAL AND METHODS

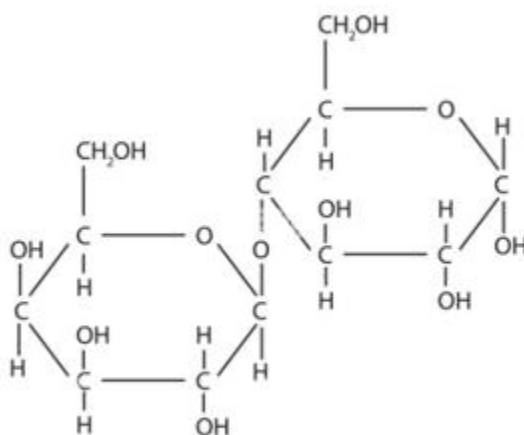
A. Materials

The raw materials and excipients utilized in this formulation comprise:

- *Active Herbal Powders:* Fenugreek seed powder, Jamun powder.
- *Excipients and Preservatives:* Methyl paraben, Starch, Talc, Magnesium stearate, Lactose, Acacia.

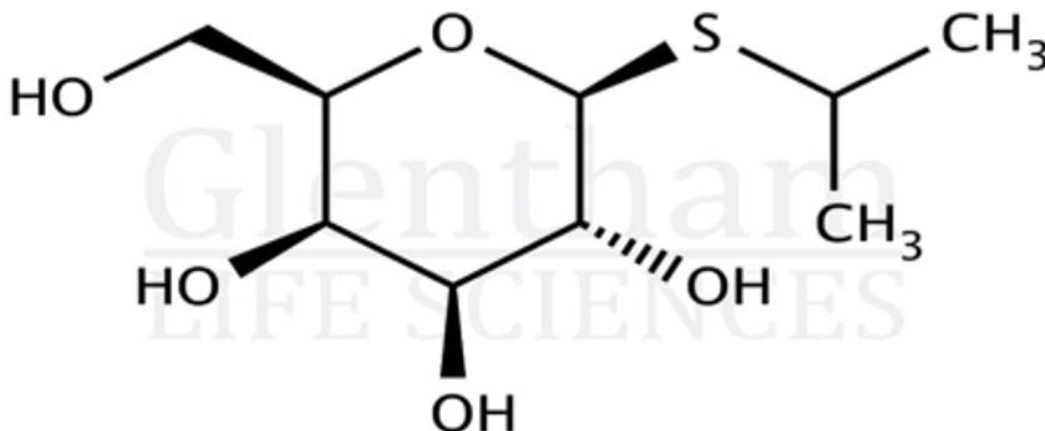
B. Drug and Excipient Profile

1) Lactose



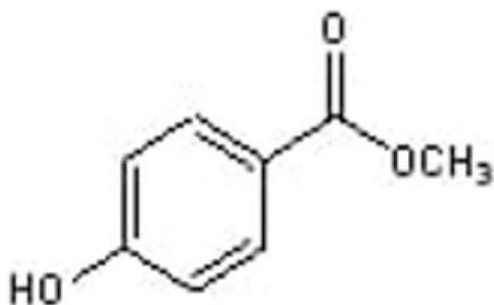
- :
- **Chemical Name:** Lactose Monohydrate
 - **CAS Number:** 64044-51-5
 - **Molecular Weight:** 360.31 g/mol

2) Talc



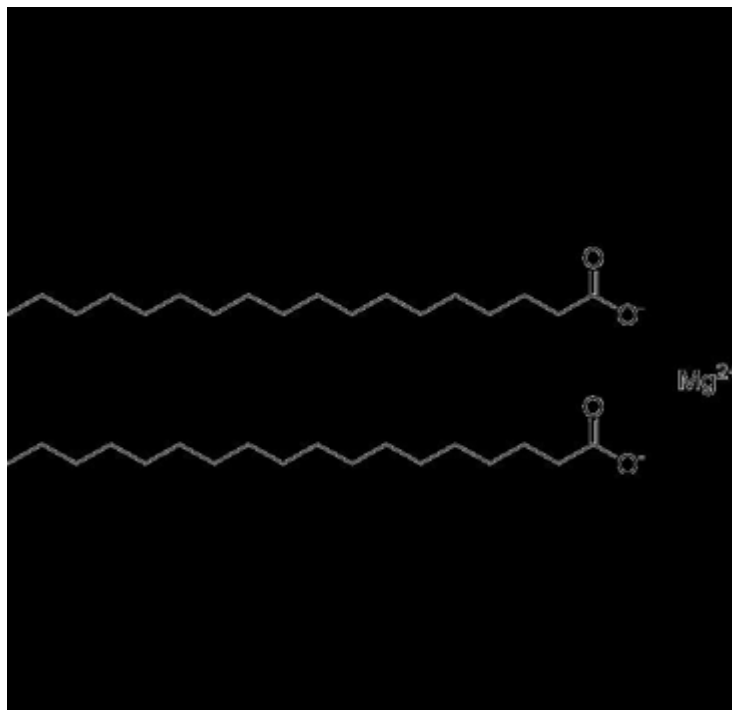
- **Chemical Name:** Hydrated Magnesium Silicate
- **CAS Number:** 14807-96-6
- **Molecular Weight:** 379.27 g/mol

3) *Methyl Paraben*



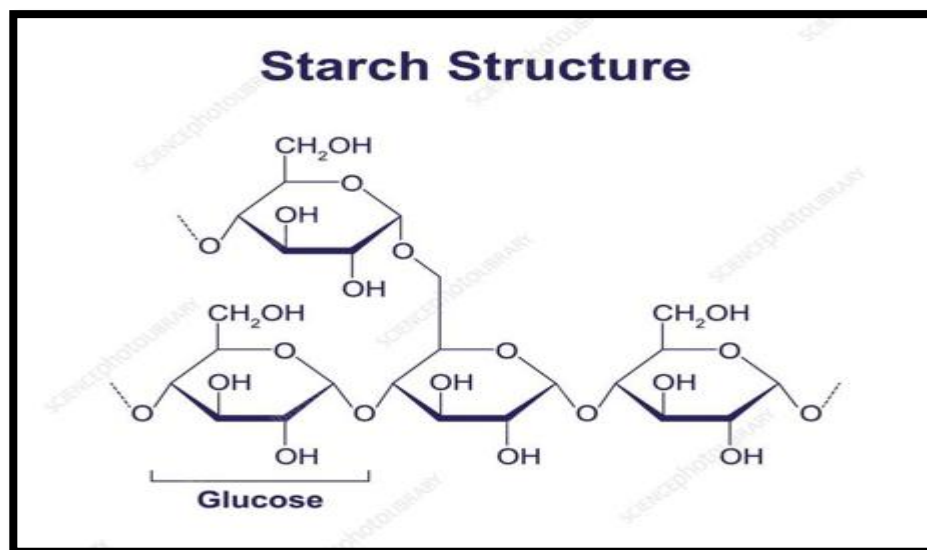
- **Chemical Name:** Methyl 4-hydroxybenzoate
- **CAS Number:** 99-76-3
- **Molecular Weight:** 152.15 g/mol

4) *Magnesium Stearate*



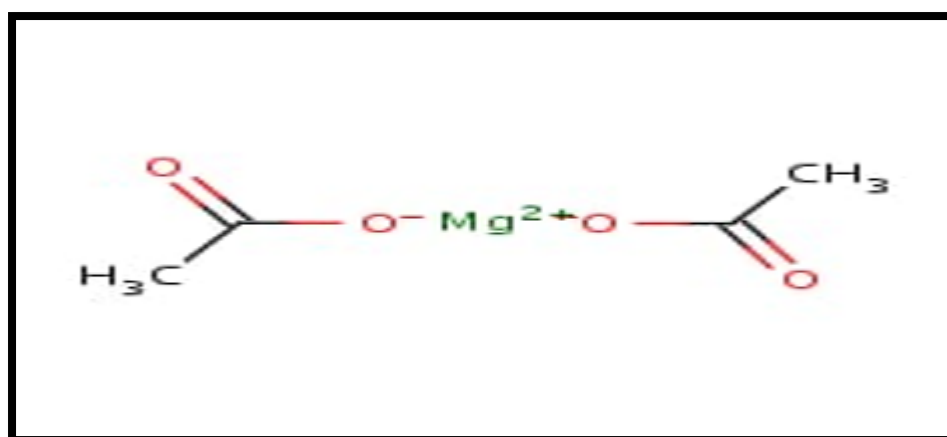
- **Chemical Name:** Magnesium octadecanoate
- **CAS Number:** 557-04-0
- **Molecular Weight:** 591.24 g/mol

5) Starch



- **Chemical Name:** Amylopectin
- **CAS Number:** 9005-25-8
- **Molecular Weight:** Variable

6) Acacia



- **Chemical Name:** Gum acacia or gum arabic
- **CAS Number:** 9000-01-5
- **Molecular Weight:** Variable

C. Experimental Work Procedure

1. Accurately weigh all active ingredients and raw materials.
2. Mix the active herbal extracts uniformly to ensure proper distribution.
3. Add the selected excipients and blend the mixture thoroughly.
4. Pass the prepared mixture through sieve no. 60.
5. Introduce lubricants at the final stage of mixing.
6. Compress the final powder blend into tablets utilizing a standard tablet punching machine.

D. Evaluation of Granules

1) Angle of Repose:

Angle of Repose

Used to determine flow property.

$$\tan \theta = \frac{h}{r}$$

Where:

- h = height of pile
- r = radius of pile

2) Bulk Density:

$$\text{Bulk Density} = \frac{M}{V_b}$$

3) Tapped Density:

$$\text{Tapped Density} = \frac{M}{V_t}$$

4) Carr's Index:

$$\text{Carr's Index} = \frac{TD - BD}{TD} \times 100$$

5) Hausner Ratio:

$$\text{Hausner Ratio} = \frac{TD}{BD}$$

IV. RESULTS AND DISCUSSION

TABLE II: EVALUATION PARAMETERS OF COMPRESSED TABLETS

Sr. No.	Evaluation Parameter	Result DOCX
1	Hardness (kg/cm^2)	6.4 kg/cm^2
2	Thickness (mm)	3.01 mm
3	Friability (% loss)	1.5 %
4	Weight variation (mg)	514 mg
5	Disintegration Time (min)	15 min

A. Discussion

- **Variation in Herbal Composition:** The concentration of active constituents may vary due to differences in plant species, geographical location, harvesting season, and processing methods, leading to inconsistent therapeutic effects.
- **Lack of Standardization:** Standardizing herbal ingredients is challenging because herbal extracts contain multiple bioactive compounds, making it difficult to ensure batch-to-batch uniformity.
- **Limited Clinical Evidence:** Many polyherbal formulations have insufficient clinical trials to conclusively establish their efficacy and safety in diabetic patients.
- **Potential Herb–Drug Interactions:** Polyherbal tablets may interact with conventional antidiabetic medications, potentially causing adverse effects such as hypoglycemia or altered drug activity.
- **Difficulty in Identifying Active Components:** Since multiple herbs are combined, determining which constituent is responsible for the therapeutic effect can be difficult.
- **Stability Issues:** Herbal products may be susceptible to degradation due to moisture, temperature, light, and oxidation, affecting shelf life and effectiveness.
- **Risk of Contamination:** Herbal raw materials may contain contaminants such as pesticides, heavy metals, microorganisms, or adulterants if quality control is inadequate.
- **Complex Formulation Process:** Developing a stable and effective polyherbal tablet requires careful selection of herbs, excipients, and manufacturing methods, which can be time-consuming.
- **Variable Bioavailability:** Some herbal constituents have poor absorption and bioavailability, which may reduce the overall therapeutic efficacy of the formulation.
- **Regulatory Challenges:** Herbal formulations often face less stringent regulations than synthetic drugs, which can lead to inconsistencies in quality, safety, and efficacy.
- **Slow Onset of Action:** Polyherbal preparations may act more gradually than conventional antidiabetic drugs and may not be suitable for rapid glycemic control.
- **Patient Compliance Issues:** Some herbal tablets may have an unpleasant taste, odor, or require prolonged use before noticeable benefits are observed.

V. SUMMARY & CONCLUSION

There is abundant reported data regarding the antidiabetic potential of plants and their use as cost-effective traditional medicines easily available for poor populations. From an early era, people have been treating diseases, including diabetes, with herbal medicine. In the present era, researchers are still using conventional medicines and improving the action of medicine effectively with fewer or no harmful side effects. Some studies have proved that compounds extracted from herbal plants tend to be more effective. By using these medicinal plants alongside marketed drugs, the plant constituents can efficiently act on target sites, improving the overall bioavailability and decreasing toxicity. Hundreds of plants, including jamun, fenugreek, and ginger, help reduce the risk of diabetes and its secondary complications. Fruits like strawberry and grapefruit have high antioxidant potential, which aids in mitigating diabetes risks efficiently due to high amounts of Vitamin C and dietary fiber.

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