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ANTI-DIABETIC TABLET FROM BANANA PSEUDOSTEM POWDER – A REVIEW.

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Abstract

This study focused on creating a tablet formulation of banana stem powder that preserves its nutritional value and to manage the type II Diabetes mellitus can be easily reconstituted, addressing the challenges of preservation and consumption. The stem of Musa paradisiaca was analyzed for its phytochemical composition and pharmacological activity. The investigation revealed the presence of various compounds, including starch, sugars, flavonoids, phenolic, glycosides, lipids, and alkaloids. Additionally, the stem extract demonstrated potential antidiabetic effects, as evidenced by its inhibition of alpha-amylase and alpha-glucosidase enzymes. The powder was characterized based on its moisture content, bulk density, flowability, and nutritional composition. The resulting product provides a convenient and sustainable way to harness the health benefits of banana stem tablet in medicinal applications. Future research can investigate its potential uses in functional foods and nutraceuticals. Banana stem tablet is a nutrient-rich supplement that contains lipids, proteins, carbohydrates, and dietary fiber, in addition to its medicinal properties. Its potential health benefits include managing diabetes, facilitating detoxification, improving digestion, and promoting diuresis. Banana stem powder shows promise as a natural preservative in food products, potentially enhancing quality and shelf life while reducing waste and increasing profitability.

Key words: Banana stem, Tablet, Type II Diabetes mellitus, Health benefits, Excipient

Introduction

The banana plant (Musa Paradisiaca L.) is a valuable resource with various medicinal applications. Its different parts have been traditionally used to treat several health conditions. Notably, the pseudo-stem extract of the banana plant has demonstrated potential anti-diabetic effects. Research suggests that the banana plant's phytochemicals may inhibit carbohydrate-digesting enzymes, such as α-glycosidase and α-amylase. This inhibition can help regulate blood sugar levels. Additionally, the plant's fiber content can slow down the release of sugar and fats into the bloodstream. The banana plant is also a rich source of vitamin B6, which plays a crucial role in producing hemoglobin and insulin. The plant's potential health benefits make it a promising area of study for managing diabetes and other related complications.[1]

Type 2 diabetes mellitus (T2DM) is a widespread chronic metabolic disorder that has been increasingly prevalent globally. This trend is expected to lead to a significant rise in the number of affected individuals, particularly in developing countries, where healthcare systems may face substantial challenges. The development of T2DM is primarily attributed to two key factors: impaired insulin secretion by pancreatic β-cells and reduced responsiveness to insulin in target tissues.

The World Health Organization (WHO) defines diabetes mellitus as a chronic condition marked by elevated blood glucose levels, which can lead to long-term damage to various organs and tissues. T2DM accounts for over 90% of diabetes cases and is characterized by inadequate insulin secretion, insulin resistance, and a compromised compensatory insulin response.

Key aspects of T2DM include:

- Impaired insulin secretion: Pancreatic β-cells fail to produce sufficient insulin.
- Insulin resistance: Target tissues become less responsive to insulin.
- Chronic complications: Untreated or poorly managed T2DM can lead to damage to the heart, vasculature, eyes, kidneys, and nerves.[2]

For centuries, natural products have been utilized for their therapeutic properties to treat various diseases and illnesses. These products, derived from minerals, plants, and animals, serve as primary sources of medicinal compounds. The *Musa paradisiaca* (MP) plant, a member of the Musaceae family, is a notable example of a medicinal plant with a rich history. With over 40 species, MP is known for its distinctive characteristics, including its pseudo-stem, large elongated leaves, and cylindrical fruits.

MP is widely cultivated in tropical regions, including India, America, Australia, Africa, Malaysia, and South America. Research has revealed that MP possesses a range of pharmacological activities.

The plant's chemical composition includes tannins, saponins, sterols, triterpenes, and proanthocyanidins. Given its broad range of pharmacological activities, MP has attracted significant research interest. This study aims to investigate the in vitro antidiabetic efficacy of the MP stem, which is believed to contain potential chemical constituents with therapeutic value.[3]

Materials and Methods

Plant Profile-

Fig.1. Banana Plant

Plant Name – *Musa×paradisiaca*
Synonym- Banana Plant
Genus- Musa
Family- Musaceae
Geographical source- Southeast Asia

So, basically this study focuses on the of banana stem part to study the anti diabetic activities by studying the chemical constituent of banana stem and their action.

The *Musa Paradisiaca* powder is mainly use for this review purpose. The product made from stem of the banana plant, scientifically known as Musa paradisiacal. Banana stem is rich in fiber, which is great way to treat diabetes. It is very fine powder obtain by performing various processes.

Fig.2. Banana Stem

Banana pseudostem- The banana plant's pseudo-stem resembles a trunk, comprising a soft central core surrounded by tightly wrapped leaf sheaths. As the plant matures, these sheaths unfurl to form recognizable banana leaves. The plant can grow up to 7.5 meters tall, with the leaf sheaths emerging from the base. The inner leaves, which develop first, can reach lengths similar to the plant's height, while the outer leaves, which emerge later, are typically shorter. The banana leaves themselves can span up to 30 centimeters in width.[8]

Chemical Constituent-

Chemical composition	Concentration
Cellulose	50-60%
Hemicelluloses	15-25%

Lignin	10-18%
Pectin	3-5%
carbohydrates	29%
Moisture content	7-13%

Table 1- Chemical constituent. [9]

Excipients

Banana stem powder itself has been its high fiber content, mucoadhesive properties and potential for sustained release formulation.

Banana stem powder has also ability of biodegradability and biocompatibility. [10]

1. Diluents
   Diluents are added to solid unit dosage forms to increase bulk when the drug dosage is too small. These inactive ingredients help create a more manageable and producible tablet.
   Eg- Microcrystalline cellulose, starch
2. Disintegrants
   Disintegrants are used to facilitate the breakup or disintegration of tablets after administration, allowing the active ingredients to be released and absorbed by the body.
   Eg – Starch, cellulose
3. Binders
   Binders enhance powder flow properties by creating granules with specific size and hardness, improving the overall flowability and manufacturability of the material.
   Eg- Starch, Gelatin, Polyvinyl Pyrolidone.
4. Lubricant
   Lubricants form a thin film at the interface between the tableting mass and die wall, reducing friction and facilitating smooth tablet ejection.
   Eg- Stearic acid, Magnesium stearate.
5. Colouring Agent
   Colorants are used to add color to pharmaceutical products, enhancing their appearance and facilitating identification.
   Eg- Sunset Yellow FCF, tartarazine. [11]

Procedure

This study investigates the formulation of antidiabetic tablets using banana pseudostem powder as the active ingredient, prepared by wet granulation and compression. The potential benefits of banana pseudostem powder as an antidiabetic agent are being explored in this study.

General method for the wet granulation for compressing tablet is given-

1. The banana stem powder, starch, and preservatives were mixed with water and gelatin.
2. The mixture was triturated and passed through sieves to form granules.
3. The granules were dried at a controlled temperature.
4. Additional Excipients were mixed with the dried granules.
5. The final blend was compressed into tablets using a single punching machine. [12]

Dry Granulation

Dry granulation is a process where powders are aggregated without the use of a liquid. This method is suitable for moisture-sensitive materials.

Steps:

1. Weighing and Blending: Accurately weigh the active ingredient (banana pseudostem powder) and Excipients.
2. Roller Compaction or Slugging: The powder blend is compacted using a roller compactor or slugger to form a solid mass.
3. Milling: The compacted mass is milled into granules.
4. Sieving: The granules are sieved to achieve a uniform size distribution.
5. Blending with Lubricants: The granules are blended with lubricants (e.g., magnesium stearate) to improve flow ability.
6. Compression: The final blend is compressed into tablets using a tablet press.

Ingredient	Information	Excipients
Active Ingredient- Banana stem powder	The banana plant (Musa Paradisiaca L.) is a valuable resource with various medicinal applications. Its different parts have been traditionally used to treat several health conditions. Notably, the pseudo-stem extract of the banana plant has demonstrated potential anti-diabetic effects. Research suggests that the banana plant's phytochemicals may inhibit carbohydrate-digesting enzymes, such as α-glycosidase and α-amylase. [1]	
Diluents- Microcrystalline cellulose	Microcrystalline cellulose is popular Excipients due its strong dry binding properties, excellent tabletability & wide range of application. Its versatility and effectiveness make it widely used Excipient.	

Disintegrants- Starch	Starch is highly versatile excipients, widely utilized in the food and pharmaceutical sectors. It enhances the product texture and stability. It also facilitates tablet formation and breakdown.[14]	
Lubricant- Stearic acid	Stearic acid serves as a lubricant in various industries, including pharmaceuticals and plastics. It facillates smooth powder flow and preventing machinery sticking during tablet manufacturing	
Colouring agent- Sunset Yellow FCF	This dye is characterized by its reddish-yellow powder appearance, which dissolves into bright orange aqueous solution. As a monoazo dye, its commonly paired with other dyes like amaranth to create a brown colour.[15]	

Table no-2- Excipients

Conclusion

A pilot study rooted in traditional oriental medicine explored banana stems as a potential source of bioactive compounds, utilizing a natural waste material.

The banana stem appearing as a waste of the banana plant but it consist better health properties. Based on this preliminary study, follows up investigation are planned to better understand the above observation and to identify most potent antidiabetic compound. The banana stem powder can efficiently can controlled α-amylase and α- glycosidase

Banana stem water powder holds promise, but further research is necessary. Key areas of focus include optimizing production, improving quality and shelf-life, and exploring new applications. Collaboration among researchers, industry experts, and policymakers is vital to unlocking its full potential as a sustainable resource.

By compressing the banana stem powder into tablet it makes more easy administration and also gives constant antidiabetic effect

Converting banana stem powder into tablet it minimizes the waste and generates a valuable product with multiple uses, supporting sustainable practices

Banana stem exhibits potential in managing diabetes due to its hypoglycemic properties and presence of beneficial phytochemicals, as evidenced by promising results in animal and laboratory studies.

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