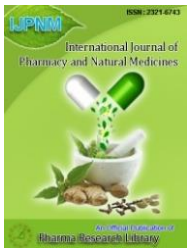

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In-Vitro Evaluation of *Moringa oleifera* Leaves Powder for Antidiabetic Activity

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A B S T R A C T
Moringa oleifera Lam., also known as the 'drumstick tree,' is recognized as a vibrant and affordable source of phytochemicals, having potential applications inmedicines, functional food preparations, water purification, and biodiesel production. (Saini, R. K., Sivanesan, I., & Keum, Y. S. (2016)). Diabetes mellitus is a chronic metabolic condition which is caused by increased sugar in the blood due to either defect of insulin secretion or action or even both. There have been side effects related to the use of traditional medicines prompting the search for new antidiabetic drugs. Moringa oleifera is popularly known as drumstick tree and it has been used for medicinal purposes traditionally. The purpose of this experiment is to find out how effective the powder from moringa leaves can be in controlling diabetes using different tests that imitate those in the body. This study aims to evaluate the in vitro antidiabetic potential of drumstick leaves powder through various biochemical assays.

Keywords: Moringa oleifera, Glucose metabolism, Blood sugar regulation, In vitro evaluation, Diabetes mellitus

A R T I C L E I N F O

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C o n t e n t s

1. Introduction

According to the World Health Organization, diabetes mellitus is amongst the top ten leading causes of mortality and morbidity around the world (World Health Organization, 2022). Diabetes is a metabolic disorder that is characterized by a state of hyperglycemia, that occurs alongside dysregulations in insulin levels and in some cases, it arises concurrently to overweight and obesity (International Diabetes Federation, 2021). Indeed, excessive body fat or obesity remains the major culprits in the development of type 2 diabetes (T2D), which is the predominant form of diabetes (International Diabetes Federation, 2021). The rapid increase in cases of diabetes mellitus, especially T2D, raises concerns, also highlighting an urgent need to investigate effective therapies to curb this disease (Ahmad et al., 2019). Accumulative research has focused on understanding the pathophysiological mechanisms implicated in the development of diabetes-associated complications, which is essential to discover effective therapies that can improve metabolic function and prevent multiple organ failure in those affected by this condition (King and Brownlee, 1996; Fowler, 2007; Wei et al., 2020).

Moringa oleifera is a medicinal plant that has gained a lot of interest for its diverse biological properties. Reviewed evidence indicates the biological capabilities of this plant expand to protecting against complications linked with heart disease, cancer, fatty liver, and diabetes mellitus

(Paikra et al., 2017; Vergara-Jimenez et al., 2017; Abd Rani et al., 2018). For example, a previously published review supported the beneficial effects of the leaves of the Moringa oleifera in improving blood glucose control in experimental models of diabetes (Ahmad et al., 2019). Notably, this review indicated draw backs such as the limited number of studies that have reported on the potential beneficial effects of this plant, including the fact that summarized literature was mainly conducted in animals, through in vitro and in vivo preclinical models. Nevertheless, while such information already affirms the hypoglycaemic potential of this medicinal plant, data regarding the prominent biochemical mechanisms implicated in the antidiabetic effects of Moringa oleifera have not been critically reviewed. ts leaves are rich in vitamins, minerals, and phytochemicals like flavonoids, phenolics, glucosinolates, which are believed to contribute to its medicinal properties. This study focuses on the in vitro evaluation of drumstick leaves powder for its antidiabetic activity, exploring its potential to inhibit key enzymes involved in carbohydrate metabolism.

2. Materials & Methods:

Preparation of Drumstick Leaves Powder

The leaves of fresh drumstick were plucked, cleansed thoroughly, and dried under the shade. Thereafter, we ground them in a mechanical grinder; then kept this powder in an airtight container for storage.

3. Results and Discussion

Table 1: Qualitative analysis of crude extract Moringa leaves

Types of tests	Sample (100mg/ml)
Alkaloid	+
Carbohydrates	+
Terpenoid	-
Glycoside	+
Steroid	+
Saponin	+
Flavanoid	+
Phenols	+

Table 2: Quantitative analysis of crude extracts of Moringa leaves

SI.NO	Chemical component	Percentage yield (%)
1	alkaloid	9.82
2	carbohydrates	1.23
3	terpenoid	-
4	glycoside	7.61
5	steroid	5.23
6	saponin	18.27
7	flavanoid	8.91
8	phenols	8.51

Table 3

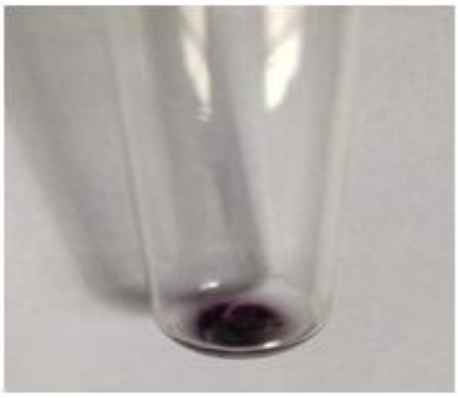
Sample	Conc (µg/ml)	ODat405nm	% inhibition	IC50valueug/ml
Acarbose	Control	0.883	0	0.17
	0.0125	0.825	6.57	
	0.025	0.798	9.63	
	0.05	0.73	17.33	
	0.1	0.577	34.65	
	0.2	0.43	51.30	
	0.4	0.308	65.12	
Sample	15.63	0.776	12.12	238.4
	31.25	0.676	23.40	
	62.5	0.658	25.53	
	125	0.548	37.91	
	250	0.397	55.09	
	500	0.284	67.84	

Table 4

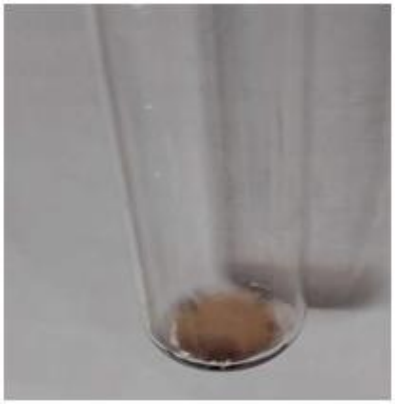
Sample	Conc(µg/ml)	OD at 510nm	% inhibition	IC50 value (µg/ml)
Acarbose	Control	0.768	0	1.5 5
	0.1562	0.718	6.51	
	0.3125	0.628	18.23	
	0.625	0.584	23.96	
	1.25	0.427	44.40	
	2.5	0.278	63.80	
	5	0.185	75.91	
Sample	25	0.678	11.72	24 5.6
	50	0.612	20.31	
	100	0.529	31.12	
	200	0.437	43.10	
	400	0.324	57.81	
	800	0.215	72.01	

Alkaloids

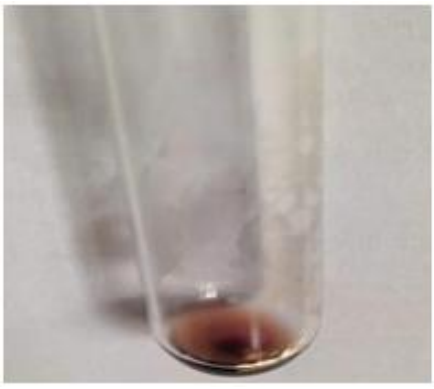
Glycoside



Carbohydrates



Steroid



Terpenoids

Saponinsaponin

Figure.1: Phytochemicals

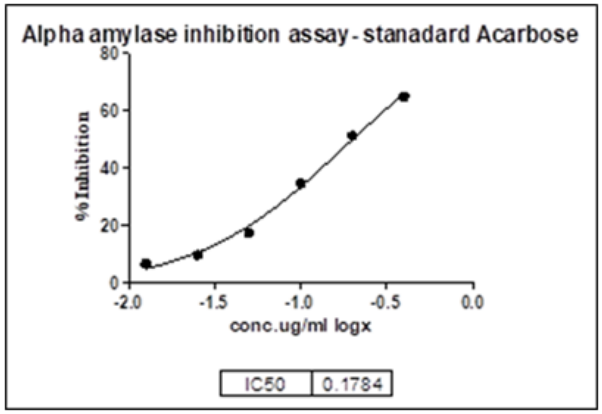


Figure.2

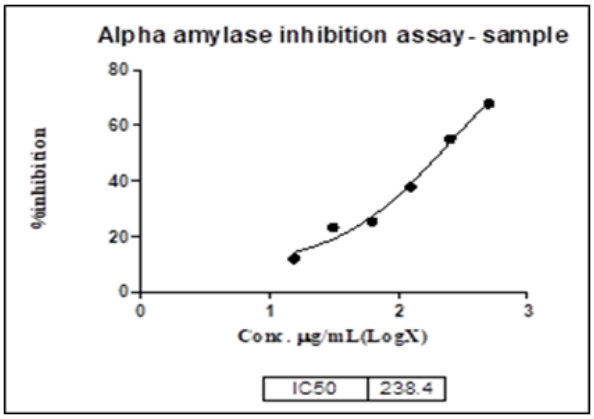


Figure.3

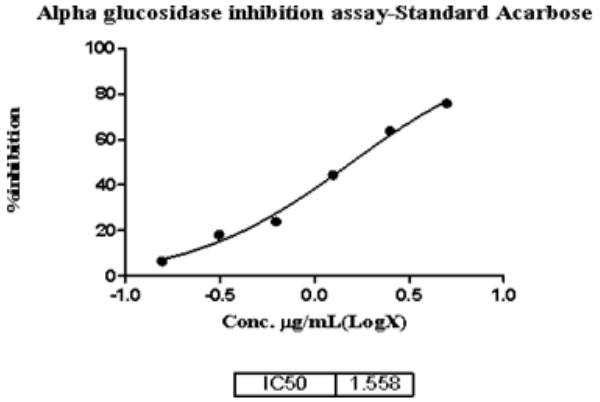


Figure.4

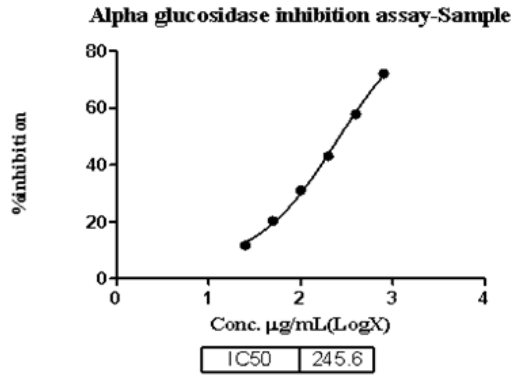


Figure.5

Phytochemical Analysis:

The phytochemical constituents of the drumstick leaves powder were qualitatively determined for the presence of flavonoids, phenolics, saponins, tannins, and alkaloids using standard procedures.

Sample Preparation: Dissolved 100 mg of sample in 1 ml of methanol.

Alpha-Amylase Inhibition

The assay alpha-amylase inhibition was conducted to study the effect of drumstick leaf powder on alpha amylase enzyme which is of vital importance in carbohydrate digestion. Acarbose was used as positive control. The reaction mixture consisting of starch substrate, alpha-amylase enzyme and different concentrations of drumstick leaf powder as documented in table 2 were incubated at room temperature and stopped by adding DNS reagent (dinitro salicylic acid), and its absorbance recorded at 540 nm. Percentage inhibition was determined as per table 2.

Critical Control Points were Ionic concentration of buffer, Incubation temperature and time. Storage conditions of the reagents.

Alpha-Glucosidase Inhibition

The Alpha-Glucose inhabitation method was employed investigate if there is any change in activity level on Alpha-Glucosidase enzyme caused by Moringa Oleifera leaf extract. Dose dependent inhibition of the enzyme alpha-glucosidase by drumstick leaf extract was observed. The IC50 value correlated closely with standard acarbose.The final step in carbohydrate digestion involves alpha-glucosidase enzyme that will break down p-nitrophenyl-α-D-glucopyranoside (pNPG) substrate to yield glucose and p-nitrophenol according to Oloyede et al., (2010).

- The tested sample showing significant alpha glucosidase inhibition activity with IC50 value of 245.6ug/ml.
- Acarbose used as the standard has showedIC50 value of1.55µg/ml.

Discussion

It has been demonstrated that dried powdered leaves of Drumsticks have significant anti-diabetic potential, explainable through key diabetic enzymes inhibition and improved ability to take up glucose molecules. They are believed to be rich sources of bioactive substances such as flavonoids and phenolics. These results back up the conventional use of Moringa oleifera for diabetes management and show its possible use as natural substitute for antidiabetic treatment.

4. Conclusion

The findings of this study provide substantial evidence that Moringa oleifera leaves powder possesses significant antidiabetic properties when evaluated through in vitro assays. The bioactive compounds present in Moringa oleifera effectively enhance glucose metabolism and improve insulin sensitivity, which are crucial for managing diabetes mellitus. These results underline the potential of Moringa oleifera as a natural and effective alternative for

diabetes treatment, supporting its use in traditional medicine and highlighting its promise for future therapeutic applications.

The demonstrated hypoglycemic effects of Moringa oleifera leaves powder offer a valuable addition to the array of natural remedies for diabetes, emphasizing the importance of further in vivo studies and clinical trials to validate these findings and elucidate the underlying mechanisms. Additionally, this research underscores the need for the development of standardized preparations and dosage guidelines to maximize the therapeutic benefits of Moringa oleifera.

In conclusion, Moringa oleifera leaves powder emerges as a promising candidate for antidiabetic therapy, providing a natural, accessible, and cost-effective option for individuals with diabetes. Continued exploration and integration of such medicinal plants into mainstream healthcare can significantly enhance the management and treatment of diabetes, ultimately improving patient outcomes and quality of life.

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