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Glucose lowering effects and *in vitro* α-amylase and α-glucosidase inhibitory potentials of aqueous extract of *Adansonia digitata* (baobab) seed

Chaired by DR. ALFREDO BERZAL-HERRANZ;
Co-Chaired by PROF. DR. MARIA EMÍLIA SOUSA

pharmaceuticals MDPI

Khalifa Umar Bashir[1] and Habibu Tijjani[1,2]

[1]Department of Biochemistry, Natural Product Research Laboratory, Bauchi State University Gadau, Nigeria
[2]Department of Science Laboratory Technology, Natural Product Research Laboratory, Bauchi State University Gadau, Nigeria

- Corresponding author: haatscific@gmail.com; habibtijjani@basug.edu.ng

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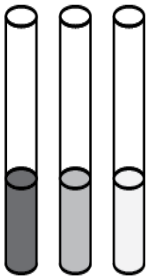
Graphical Abstract

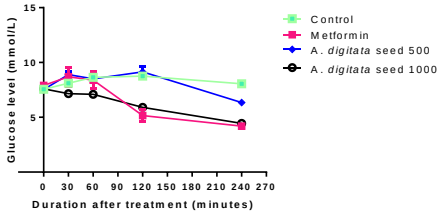
Adansonia digitata **(baobab) seed**

Antihyperglycemic Experiment

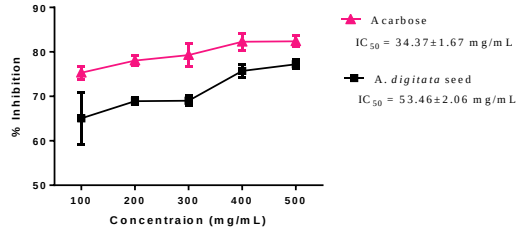


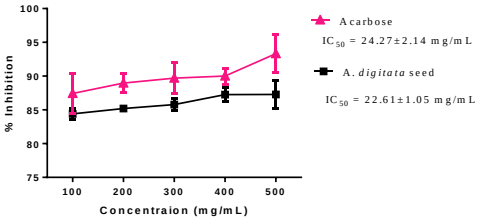
In vitro **Antidiabetic Assays**

Antihyperglycemic effects



Antidiabetic effects





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Abstract:
Adansonia digitata L. (*Malvaceae*, Baobab) is a medicinal tree with antimicrobial, antiviral, anti-inflammatory, and antioxidant properties. The leaves, fruit pulp, stem bark, and roots have been extensively studied. The aim of this study was to evaluate the glucose-lowering and *in vitro* antidiabetic potentials of the aqueous extract of *A. digitata* seed. The aqueous extract of *A. digitata* seed was prepared by dissolving 50g of powder seed in 500 mL of distilled water for 24 hours, filtered using Whatman filter paper, and concentrated using a rotary evaporator at 40°C. Following an oral administration of glucose (2 g/kg body weight), distilled water, metformin (14.2 mg/kg body weight), and *A. digitata* seed extracts at 500 and 1000 mg/kg body weight. respectively. Results show that the untreated mice had an average of 11.09% increase in plasma glucose concentration, while metformin, aqueous seed extract of *A. digitata* had an average of 17.05%, 0.99%, and 19.21% decrease in plasma glucose concentration respectively. The aqueous seed extract of *A. digitata* inhibited α amylase in a concentration-dependent manner with an IC_{50} of 24.27±2.14 mg/mL compared with acarbose with IC_{50} of 22.61±1.05 mg/mL. However, the α-glucosidase inhibitory activities of the extract (IC_{50} 34.37±1.67 mg/mL) were significantly lower compared to acarbose (IC_{50} 53.46±2.06). The study concludes that aqueous seed extract of *A. digitata* possesses glucose-lowering properties, *in vitro* α-amylase and α-glucosidase inhibitory potentials. Further studies will required a bioguided fractionation of aqueous seed extract of *A. digitata*, to identify its phytochemical constituents using fingerprint chromatography among other techniques.
Keywords: *Adansonia digitata*; Antihyperglycemia; *In vitro*; Seed; *α*-Amylase; *α*-Glucosidase

Introduction

Adansonia digitata L. (*Malvaceae*; Baobab) is a medicinal plant wide distribution throughout the sub-Saharan Africa and Western Madagascar areas. Their many important use include medicinal, beverages, and as food (Lamien-meda *et al.*, 2008).

Diabetes mellitus is a common and prevalent disease with estimated 1.5 million deaths in 2019 and reported 48% of death cases occurring before 70 years (WHO, 2021). Diabetes is a chronic metabolic disorder of fats, proteins, and carbohydrate metabolism, which are linked to insulin functions; blood insulin level or insensitivity of target organs or both (Ghosh *et al.*, 2004). Diabetes are associated with oxidative stress (Tijjani *et al.*, 2020a) and hyperlipidemia (Tijjani *et al.*, 2020b).

The seed of *A. digitata* (baobab) are used traditionally for the management of diabetes and its complications, among other derived benefits. The present study was designed to evaluate the glucose lowering properties, and *in vitro* antidiabetic potentials of the aqueous extract of *A. digitata* seed.

Materials and methods

Chemicals and reagents

α – amylase, α – glucosidase, metformin, *p*-Nitrophenyl-α-glucopyranoside (PNPG) and 3, 5-dinitrosalicylic acid (DNSA) were purchased from Sigma-Aldrich, Germany. All other reagents used were of analytical grade.

Experimental animals

Sixteen (16) albino mice weighing between 20±2 g where purchase from the animal unit, University of Jos, Plateau state and acclimatized for 14 days in a plastic cage of 4 mice each, given standard mouse chow and water *ad libitum*. The animal care procedure was approved by the ethical review committee, University of Jos, with registration number UJ/FPS/F17-00379.

Assays

Antihyperglycemic assay was determined according to the method of Du Vigneaud and Karr (1925), while α-amylase and α-glucosidase inhibition assays was determine according to Andrade-Cetto *et al.* (2008) and Kuppusamy *et al.* (2011).

Results and discussion

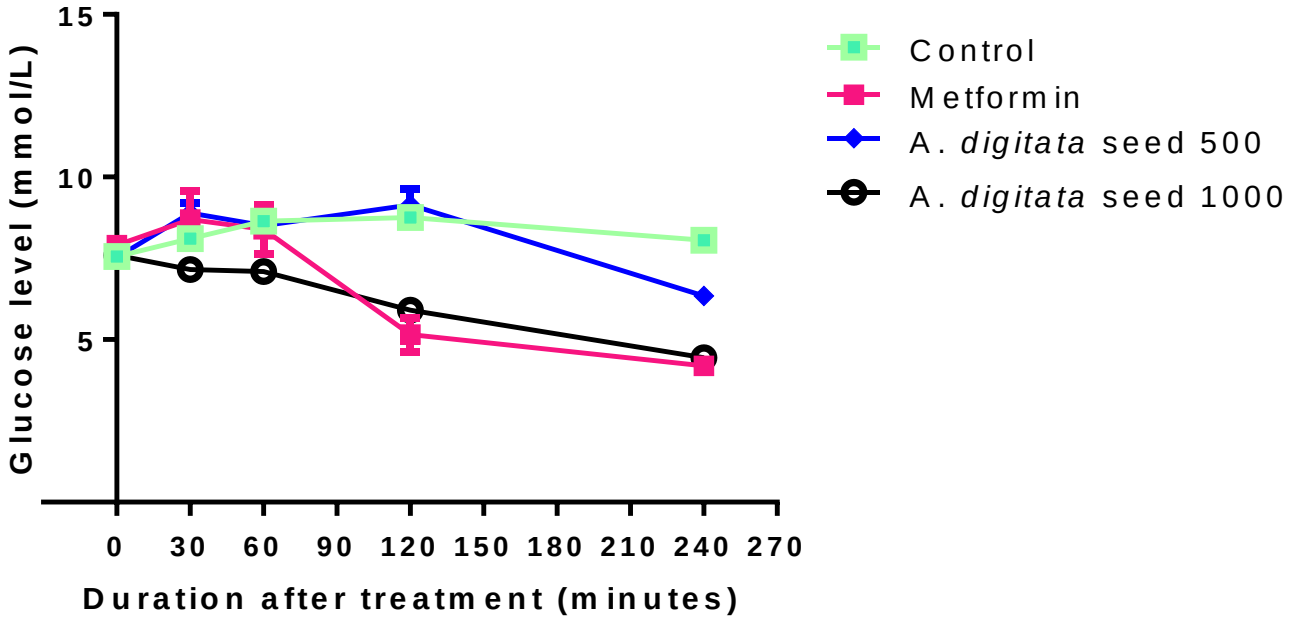

Figure 1: Antihyperglycemic effects of aqueous seed extract of *A. adigitata* in experimental mice. Values are mean ± SD, n=4, Dosages are in mg/kg body weight

Results and discussion

Table 1: Percentage decrease in blood glucose levels following treatments with aqueous seed extract of *A. digitata* in experimental mice

Groups (mg/kg bwt)	Effects on glucose level (%)					
	0 minutes	30 Minutes	60 Minutes	120 minutes	240 Minutes	Average
Control	7.55	8.10 (↑7.28)	8.65 (↑14.56)	8.75 (↑15.89)	8.05 (↑6.62)	↑11.09
Metformin	7.90	8.70 (↑10.59)	8.40 (↑6.62)	5.15 (↓36.42)	4.20 (↓49.01)	↓17.05
A. digitata 500	8.30	8.90 (↑7.94)	8.50 (↑2.64)	9.15 (↑11.25)	6.35 (↓25.82)	↓0.99
A. digitata 1000	7.60	7.15 (↓5.96)	7.10 (↓6.62)	5.90 (↓22.51)	4.45 (↓41.72)	↓19.21

Values are mean, n=4, ↑ = increase, ↓ = decrease, mg/kg bwt = mg/kg body weight

Results and discussion

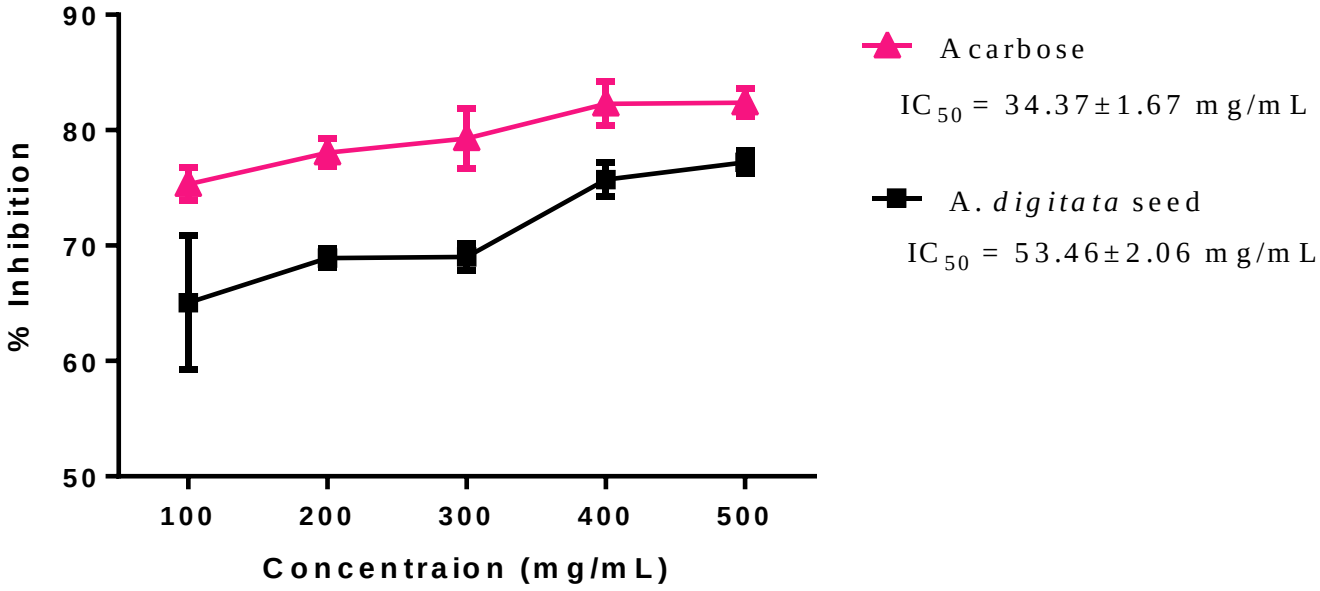

Figure 2: Inhibition of α-glucosidase by aqueous extract of *A. digitata* seed. Values are mean ± SD of triplicate determination

Results and discussion

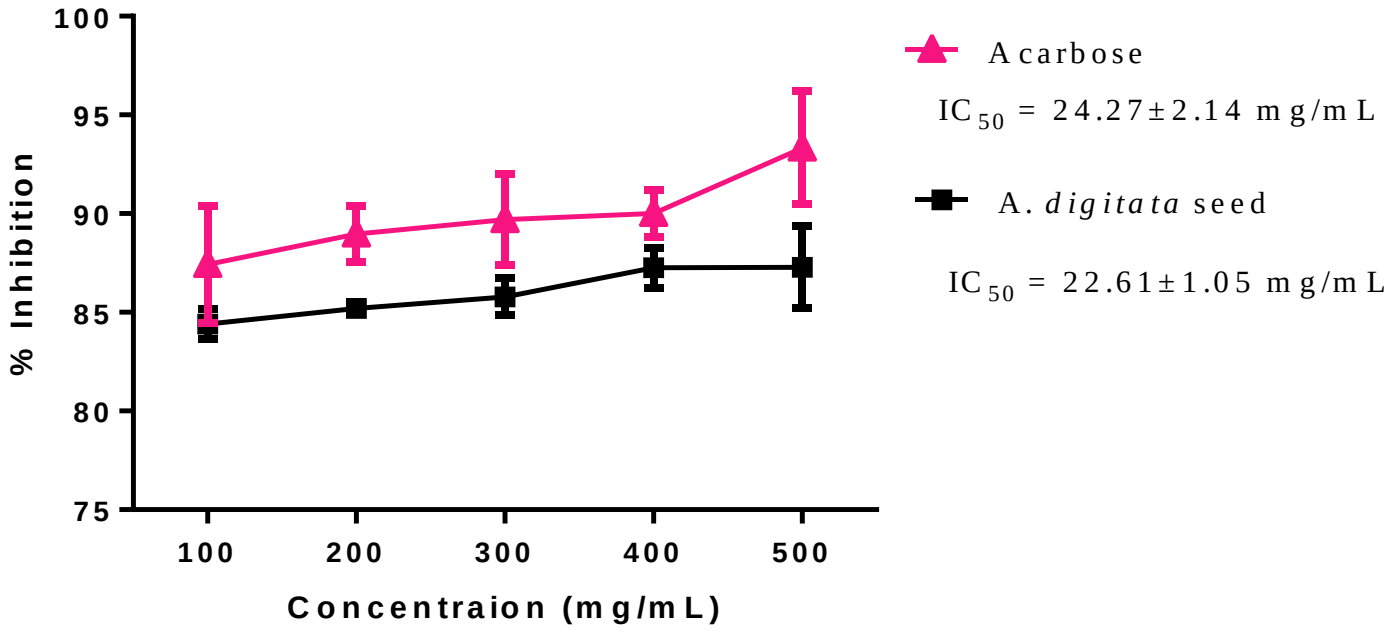

Figure 3: Inhibition of α-amylase by aqueous extract of *A. digitata* seed. Values are mean ± SD of triplicate determination

Conclusions

The study conclude that aqueous extracts of *A. digitata* seed possess both *in vitro* α-amylase and α-glucosidase inhibitory potential and possess glucose lowering effects at 500 and 1000 mg/kg body weight. Thus, providing scientific support for the usage of *A. digitata* seed in the management of diabetes mellitus. Further studies will required a bioguided fractionation of aqueous seed extract of *A. digitata*, to identify its phytochemical constituents using fingerprint chromatography among other techniques.

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Acknowledgments

Bauchi State University, Gadau, Nigeria