

In Vitro Antioxidant and Antidiabetic Evaluation of *Abrus precatorius* Leaf

Okeke Chibuzor Okechukwu¹, Nnaoma Ikenna Elvis², Joseph Rich C³, Oguebie Robinson N⁴

¹Department of Chemistry/Biochemistry, Federal Polytechnic Nekede, Owerri, Imo State, Nigeria

^{2,3,4}Department of Pharmaceutical Technology, Federal Polytechnic Nekede, Owerri, Imo State, Nigeria

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ABSTRACT

Diabetes mellitus is a major metabolic disorder associated with impaired glucose regulation and oxidative stress, creating a need for plant-derived agents with antioxidant and carbohydrate-modulating properties. This study evaluated the in vitro antioxidant and antidiabetic activities of ethanol leaf extract of *Abrus precatorius*. We extracted the leaves by cold maceration in ethanol and evaluated the resulting extract for DPPH radical-scavenging activity, ferric reducing antioxidant power (FRAP), α -amylase inhibition, α -glucosidase inhibition, and glucose adsorption capacity. DPPH radical-scavenging activity increased from $11.55 \pm 0.65\%$ at 10 mg/mL to $54.05 \pm 0.65\%$ at 80 mg/mL, while FRAP activity increased progressively from $33.75 \pm 0.34\%$ at 40 mg/mL to $68.55 \pm 0.25\%$ at 160 mg/mL. The extract inhibited α -amylase activity, with inhibition values ranging from $33.94 \pm 0.61\%$ to $45.32 \pm 0.43\%$ across the tested concentrations, although these values were significantly lower than those obtained with acarbose ($p < 0.001$). α -Glucosidase inhibition increased from $39.89 \pm 0.27\%$ at 40 mg/mL to $56.09 \pm 0.66\%$ at 80 mg/mL, also remaining lower than acarbose. Under the tested conditions, the extract's glucose adsorption capacity ranged from 5.13 ± 0.08 to 6.50 ± 0.08 mmol/g. Statistical analysis demonstrated significant effects of concentration and sample type on the evaluated antidiabetic parameters ($p < 0.001$). These findings indicate that *A. precatorius* leaf extract possesses concentration-dependent antioxidant activity and moderate carbohydrate-digestive enzyme inhibitory potential, supporting its further investigation as a potential source of bioactive compounds for diabetes management.

Keywords: Diabetes, oxidative stress, *Abrus precatorius*

INTRODUCTION

Diabetes mellitus is a major metabolic disorder characterised by persistent hyperglycaemia resulting from impaired insulin secretion, impaired insulin action, or both. Chronic hyperglycaemia is associated with excessive generation of reactive oxygen species (ROS), disruption of cellular redox balance, and oxidative damage, which contribute to the development and progression of diabetic complications (Nnaoma et al., 2026). The close relationship between abnormal glucose metabolism and oxidative stress has increased interest in therapeutic strategies capable of simultaneously addressing glycaemic dysregulation and oxidative injury. Plant-derived phenolics and flavonoids are of particular interest in antioxidant research because their chemical structures allow them to participate in free-radical scavenging and reducing reactions. Recent Nigerian research by Nnaoma and Okeke (2024) demonstrated appreciable antioxidant activity in *Platycerium bifurcatum* leaf extract, with the extract showing concentration-dependent DPPH radical-scavenging and ferric-reducing activities. The authors also reported measurable total phenolic and flavonoid contents and observed an association between phytochemical content and antioxidant activity, supporting the use of complementary antioxidant assays when evaluating medicinal plant extracts. Such

evidence is relevant to the investigation of *Abrus precatorius*, particularly because oxidative stress is closely associated with abnormal glucose metabolism and diabetic pathophysiology.

Postprandial glucose regulation represents an important therapeutic target in diabetes management. Dietary starch undergoes hydrolysis by α -amylase and subsequent conversion of oligosaccharides into absorbable glucose by α -glucosidase. Inhibition of these enzymes can delay carbohydrate digestion and reduce the rapid elevation of blood glucose following carbohydrate consumption. Although synthetic inhibitors such as acarbose are established therapeutic agents, investigation of plant-derived enzyme inhibitors remains relevant because medicinal plants may provide structurally diverse compounds capable of acting through complementary mechanisms. Recent studies have continued to identify plant flavonoids and other phytochemicals with α -amylase- and α -glucosidase-inhibitory activities, alongside antioxidant and other glucose-regulatory effects (Ojimelukwe et al., 2024).

Abrus precatorius L. (Fabaceae) is a medicinal plant distributed throughout tropical and subtropical regions, including Nigeria. Its leaves contain diverse secondary metabolites, including flavonoids, phenolic compounds, terpenoids, saponins and alkaloids, which have been associated with several biological activities. A comprehensive review of *A. precatorius* described evidence for antioxidant, hypoglycaemic and other pharmacological properties while also emphasising the importance of considering the toxicological characteristics of different plant parts (Qian et al., 2022). The distinction between leaves and seeds is particularly important because the seeds contain highly toxic constituents, whereas the present investigation specifically evaluates the leaf material.

Experimental evidence published during the past several years provides increasing support for the glucose-regulatory potential of *A. precatorius* leaves. Boye et al. (2021) demonstrated that *A. precatorius* leaf extract inhibited α -amylase and α -glucosidase and produced glucose-lowering effects in alloxan/nicotinamide-induced diabetic rats, with associated modulation of insulin, glucagon and GLP-1. These observations suggest that the antidiabetic activity of the plant may involve both interference with carbohydrate digestion and regulation of endocrine pathways controlling glucose homeostasis. Network-pharmacology and molecular-docking analyses subsequently identified several *A. precatorius* constituents and diabetes-associated molecular targets, including AKT1, MAPK1, MAPK3 and TNF-related pathways, providing additional mechanistic support for the plant's potential glucose-regulatory effects (Noor et al., 2022).

More recent experimental evidence has strengthened this biological rationale. Lankatillake et al. (2024) reported that *A. precatorius* leaf extract significantly enhanced insulin-stimulated glucose uptake in differentiated C2C12 skeletal-muscle cells and increased expression of insulin receptor substrate 1 and Akt substrate of 160 kDa. Their LC-HRMS analysis also identified 55 putative phytochemicals, including polyphenols, triterpenoids, saponins and alkaloids, supporting the chemical diversity of the leaves as a potential source of glucose-regulatory compounds. Yuan et al. (2025) further demonstrated that flavonoids isolated from *A. precatorius* leaves exhibited hypoglycaemic potential through inhibition of α -glucosidase and DPPH radical scavenging, with transcriptomic and network-pharmacology analyses implicating AGE-RAGE and other signalling pathways (Yuan et al., 2025). Evidence from Springer Nature also indicates that methanolic *A. precatorius* leaf extracts possess antidiabetic activity in experimental models, with PPARA and SCD identified among potential molecular targets (Taofeek et al., 2024).

Related research from Nigeria provides an important regional context for investigating medicinal plants against interconnected oxidative and glucose-metabolism targets. Ajah et al. (2026) reported antihyperglycaemic, antioxidant and dipeptidyl peptidase-4 inhibitory activities of a flavonoid-rich *Pteridium aquilinum* extract using integrated in vitro, in silico and in vivo approaches. The study demonstrated the continued relevance of flavonoid-rich Nigerian plant extracts as potential sources of compounds targeting multiple biochemical pathways associated with diabetes. This work is particularly relevant to the present study because it demonstrates a research framework in which antioxidant activity and antidiabetic mechanisms are investigated together rather than as isolated biological properties. More recently, Nnaoma et al. (2026) investigated *Picralima nitida* leaf extract as a potential inhibitor of α -amylase

and α -glucosidase, providing further evidence from a Nigerian medicinal-plant context that leaf-derived phytochemicals may interfere with key enzymatic steps involved in carbohydrate digestion.

Despite increasing evidence for the pharmacological potential of *A. precatorius*, differences in extraction procedures, plant material, extract concentrations and experimental models make direct comparison between studies difficult. There remains a need for additional investigations using standardised leaf extracts and complementary biochemical assays to characterise their effects on carbohydrate-digestive enzymes and oxidative processes. The present study therefore evaluated the in-vitro antioxidant and antidiabetic activities of *A. precatorius* leaf extract using DPPH radical-scavenging and ferric-reducing assays, together with α -amylase inhibition, α -glucosidase inhibition and glucose adsorption capacity. These complementary assays provide a biochemical assessment of the potential of *A. precatorius* leaves to modulate processes relevant to oxidative stress and glucose regulation.

MATERIALS AND METHODS

Study Design

An experimental laboratory-based study was conducted to evaluate the in vitro antioxidant and antidiabetic activities of *Abrus precatorius* leaf extract. Antioxidant activity was assessed using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical-scavenging and ferric-reducing antioxidant power (FRAP) assays. Antidiabetic-related activity was assessed using α -amylase inhibition, α -glucosidase inhibition and glucose adsorption capacity. Acarbose was used as the reference inhibitor for the enzyme assays, while gallic acid and BHT were used as reference antioxidant standards where applicable. The use of complementary assays allowed assessment of chemically distinct antioxidant properties and multiple in vitro mechanisms relevant to carbohydrate digestion and glucose handling.

Plant Material Collection and Authentication

Fresh, healthy and undamaged leaves of *A. precatorius* were collected from a village in Orumba South Local Government Area, Anambra State, southeastern Nigeria. The plant material was transported to the laboratory in clean containers and processed promptly. The plant was identified by a qualified botanist from the Department of Plant Science and Biotechnology, Michael Okpara University of Agriculture, Umudike, and a voucher specimen was deposited.

Preparation of Plant Material

The leaves were sorted to remove damaged material and extraneous matter and washed with clean water. The material was subsequently shade-dried at room temperature until a constant dry condition was achieved. The dried leaves were pulverised using a clean mechanical grinder and stored in an airtight, labelled container until extraction. The handling and quality-control procedures were guided by WHO recommendations for medicinal plant materials (WHO, 2011).

Preparation of Ethanolic Extract

Approximately 100 g of powdered *A. precatorius* leaves was weighed and macerated in 1,000 mL 95% ethanol for 72 h at room temperature with intermittent shaking. The mixture was filtered through muslin cloth followed by Whatman No. 1 filter paper. The filtrate was concentrated at approximately 40 °C using a water bath. The resulting crude extract was transferred to an airtight labelled container and stored at very low temperature until analysis.

Preparation of Extract Concentrations

A stock solution of the crude ethanolic extract was prepared in a suitable solvent and serially diluted to obtain the concentrations required for each assay. For DPPH analysis, 10, 20, 40 and 80 mg/mL were evaluated. FRAP analysis used 0, 40, 80, 120 and 160 mg/mL. α -Amylase inhibition and glucose adsorption

were assessed at 0, 40, 60 and 80 mg/mL, whereas α -glucosidase inhibition was evaluated at 40, 60, and 80 mg/mL. Acarbose was used as the reference inhibitor for α -amylase and α -glucosidase assays, while the designated reference antioxidants were used for antioxidant assays.

Antioxidant Assays

DPPH Radical-Scavenging Assay

DPPH radical-scavenging activity was determined using the method of Brand-Williams et al. (1995), with modifications. The assay is based on the reduction of the stable DPPH radical by antioxidant compounds, resulting in a decrease in absorbance. Brand-Williams et al. established the DPPH method as a spectrophotometric approach for evaluating free-radical-scavenging activity. A 0.1 mM DPPH solution was freshly prepared in ethanol. Aliquots (1.0 mL) of *A. precatorius* extract at 10, 20, 40 and 80 mg/mL were mixed with 2.0 mL DPPH solution. The mixtures were incubated in darkness at room temperature for 30 min. A control containing DPPH solution and ethanol without extract was prepared concurrently. Absorbance was measured at 517 nm using a UV-visible spectrophotometer.

Radical-scavenging activity was calculated as:

$$\text{DPPH Scavenging Activity (\%)} = [(A_c - A_s) / A_c] \times 100$$

Where: A_c = absorbance of the control

A_s = absorbance of the sample

The assay was performed in three independent/technical replicates, as applicable, and results were expressed as mean $\pm$ SD.

Ferric-Reducing Antioxidant Power Assay

FRAP activity was determined according to Benzie and Strain (1996), with modifications. The assay measures the ability of antioxidant compounds to reduce Fe^{3+} to Fe^{2+} , producing a coloured ferrous-TPTZ complex. The original FRAP method is a well-established spectrophotometric measure of reducing antioxidant power. FRAP reagent was prepared immediately before use by mixing 25 mL of 300 mM acetate buffer (pH 3.6), 2.5 mL of 10 mM TPTZ prepared in 40 mM HCl and 2.5 mL of 20 mM FeCl_3 . The reagent was warmed to 37 °C. Aliquots (100 μL) of extract at 0, 40, 80, 120 and 160 mg/mL were mixed with 2.9 mL of freshly prepared FRAP reagent and incubated at 37 °C for 30 min. Absorbance was measured at 593 nm against an appropriate reagent blank.

Antidiabetic-Related Assays

α -Amylase Inhibition Assay

α -Amylase inhibitory activity was evaluated using the method of Paun et al. (2020), with modifications. Paun et al. used plant polyphenolic-rich extracts to evaluate inhibition of key carbohydrate-digestive enzymes and reported α -amylase and α -glucosidase inhibition in an in vitro antidiabetic model. A 0.5 mg/mL solution of porcine pancreatic α -amylase was prepared. Extract concentrations of 0, 40, 60 and 80 mg/mL were mixed with the enzyme and pre-incubated at 37 °C for 20 min. A 1% starch solution was subsequently added, and the reaction mixture was incubated at 37 °C for 30 min. The reaction was terminated with DNS reagent, and absorbance was measured at 540 nm. A reaction mixture containing enzyme and substrate without extract served as the control, while acarbose served as the reference inhibitor.

The percentage inhibition was calculated as:

$$\alpha - \text{Amylase Inhibition (\%)} = [(A_c - A_s) / A_c] \times 100$$

where: A_c = absorbance of the control

A_s = absorbance of the reaction mixture containing the extract

A-Glucosidase Inhibition Assay

α -Glucosidase inhibitory activity was determined according to Paun et al. (2020), with modifications. α -Glucosidase from *Saccharomyces cerevisiae* (0.5 U/mL) was prepared in phosphate buffer (pH 6.9). The reaction mixture contained 50 μ L extract, 125 μ L enzyme solution and 700 μ L phosphate buffer. The mixture was pre-incubated at 37 °C for 15 min. Subsequently, 125 μ L of 5 mM p-nitrophenyl- α -D-glucopyranoside substrate was added, and incubation continued at 37 °C for 30 min. The reaction was terminated with 1,000 μ L of 0.2 M Na_2CO_3 , and absorbance was measured at 405 nm. Acarbose was used as the reference inhibitor.

Inhibition was calculated as:

$$\alpha - \text{Glucosidase Inhibition (\%)} = [(A_0 - A_1) / A_0] \times 100$$

A_0 = absorbance of the control

A_1 = absorbance of the reaction mixture containing the extract

Glucose Adsorption Capacity

The glucose adsorption capacity of the ethanol leaf extract of *Abrus precatorius* was determined using a modified method of Ou et al. (2001). Briefly, 0.5 g of the extract was accurately weighed into a 50 mL centrifuge tube, and 50 mL of glucose solution (50 mmol/L) was added. The mixture was thoroughly mixed and incubated at 37 °C for 6 h in a thermostatically controlled shaking incubator. Following incubation, the mixture was centrifuged at $4,000 \times g$ for 10 min, and the supernatant was collected for determination of the residual glucose concentration. The residual glucose concentration was determined using a glucose oxidase–peroxidase (GOD-POD) assay kit according to the manufacturer's instructions. A glucose standard curve was prepared using known concentrations of glucose, and the absorbance of the samples was measured at the wavelength specified by the kit. A control containing the glucose solution without the plant extract was treated under identical conditions.

The glucose adsorption capacity (GAC) was calculated according to the following equation:

$$\text{Glucose Adsorption Capacity} = [(C_0 - C_1) / m] \times V$$

Statistical Analysis

Data obtained from the experimental analyses were expressed as mean $\pm$ standard deviation (SD). Statistical analysis was performed using IBM SPSS Statistics version 27 and GraphPad Prism version 9. Differences between groups and the effects of extract concentration were evaluated using analysis of variance (ANOVA), as appropriate. Where significant differences were detected, Duncan's multiple range test was used for post hoc multiple comparisons. For comparisons involving extract concentration and sample type, two-way ANOVA was applied to determine the main effects and interaction effect. Statistical significance was considered at $p < 0.05$. GraphPad Prism version 9 was used for statistical analysis, graphical presentation, and plotting of the experimental data.

RESULTS

A-Amylase Inhibitory Activity

The α -amylase inhibitory activity of *Abrus precatorius* extract and acarbose at different concentrations is

presented in Table 1. The extract exhibited concentration-dependent inhibitory activity, with inhibition increasing from $33.94 \pm 0.61\%$ at 40 mg/mL to $45.32 \pm 0.43\%$ at 80 mg/mL. In comparison, acarbose produced substantially higher inhibition, ranging from $80.31 \pm 0.12\%$ to $89.76 \pm 0.42\%$ across the tested concentrations.

At each concentration, α -amylase inhibition by acarbose was significantly greater than that of the *A. precatorius* extract ($p < 0.0001$). The two-way ANOVA demonstrated significant main effects of sample type ($F(1,16) = 51,551.42$, $p < 0.001$) and concentration ($F(3,16) = 204.56$, $p < 0.001$), as well as a significant sample type $\times$ concentration interaction ($F(3,16) = 412.82$, $p < 0.001$).

Table 1. α -Amylase inhibitory activity of *Abrus precatorius* extract and acarbose at different concentrations.

Concentration (mg/mL)	<i>A. precatorius</i> (% inhibition)	Acarbose (% inhibition)
0	36.52 ± 0.62^a	79.17 ± 0.27^b
40	33.94 ± 0.61^a	89.76 ± 0.42^b
60	40.08 ± 0.76^a	80.31 ± 0.12^b
80	45.32 ± 0.43^a	83.62 ± 0.21^b

Values are mean $\pm$ SD ($n = 3$). Within each concentration, means with different superscript letters differ significantly according to Šídák's multiple-comparisons test ($p < 0.0001$).

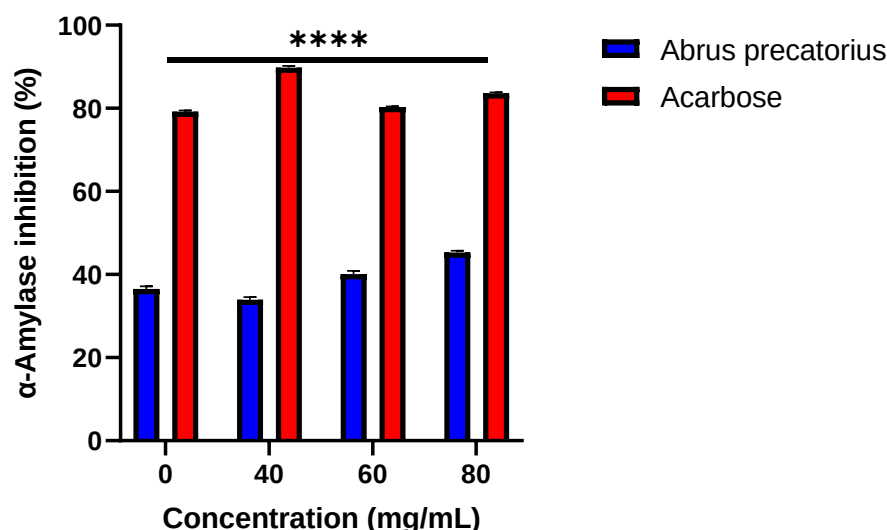


Figure 1. Effect of *Abrus precatorius* leaf extract concentration on α -amylase inhibition compared with acarbose.

α -Glucosidase inhibitory activity

The α -glucosidase inhibitory activity of the *A. precatorius* extract and acarbose is shown in Table 2. The extract demonstrated an increase in inhibitory activity with increasing concentration, from $39.89 \pm 0.27\%$ at 40 mg/mL to $56.09 \pm 0.66\%$ at 80 mg/mL. Acarbose showed higher inhibitory activity at all concentrations, with values ranging from $78.46 \pm 0.79\%$ to $81.27 \pm 0.00\%$. The inhibitory activity of acarbose was significantly greater than that of the extract at all tested concentrations ($p < 0.0001$). Two-way ANOVA

indicated significant effects of sample type, concentration, and the sample type $\times$ concentration interaction on α -glucosidase inhibition (all $p < 0.001$).

Table 2. α -Glucosidase inhibitory activity of *Abrus precatorius* extract and acarbose at different concentrations.

Concentration (mg/mL)	<i>A. precatorius</i> (% inhibition)	Acarbose (% inhibition)
40	39.89 ± 0.27^a	78.46 ± 0.79^b
60	45.13 ± 0.26^a	80.15 ± 0.79^b
80	56.09 ± 0.66^a	81.27 ± 0.00^b

Values are mean $\pm$ SD ($n = 2$). Within each concentration, means with different superscript letters differ significantly according to Šídák's multiple-comparisons test ($p < 0.0001$).

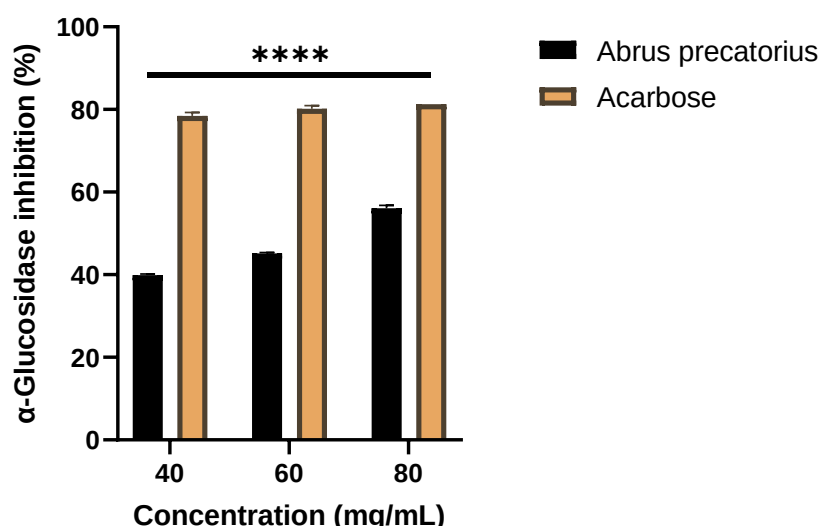


Figure 2. Effect of *Abrus precatorius* leaf extract concentration on α -glucosidase inhibition compared with acarbose.

Glucose adsorption capacity

The glucose adsorption capacity of the *A. precatorius* extract and acarbose is presented in Table 3. The extract showed a progressive reduction in glucose adsorption values with increasing concentration, from 6.50 ± 0.08 at 0 mg/mL to 5.13 ± 0.08 at 80 mg/mL. In contrast, the values observed for acarbose increased progressively from 7.38 ± 0.04 at 0 mg/mL to 18.55 ± 0.05 at 80 mg/mL. At all concentrations, the values obtained for acarbose were significantly higher than those of the *A. precatorius* extract ($p < 0.0001$). Two-way ANOVA showed significant effects of sample type, concentration, and their interaction on glucose adsorption capacity (all $p < 0.001$).

Table 3. Glucose adsorption capacity of *Abrus precatorius* extract and acarbose at different concentrations.

Concentration (mg/mL)	<i>A. precatorius</i>	Acarbose
0	6.50 ± 0.08^a	7.38 ± 0.04^b

40	6.03 ± 0.07^a	8.98 ± 0.04^b
60	5.45 ± 0.09^a	13.63 ± 0.03^b
80	5.13 ± 0.08^a	18.55 ± 0.05^b

Values are mean $\pm$ SD ($n = 3$). Within each concentration, means with different superscript letters differ significantly according to Šídák's multiple-comparisons test ($p < 0.0001$).

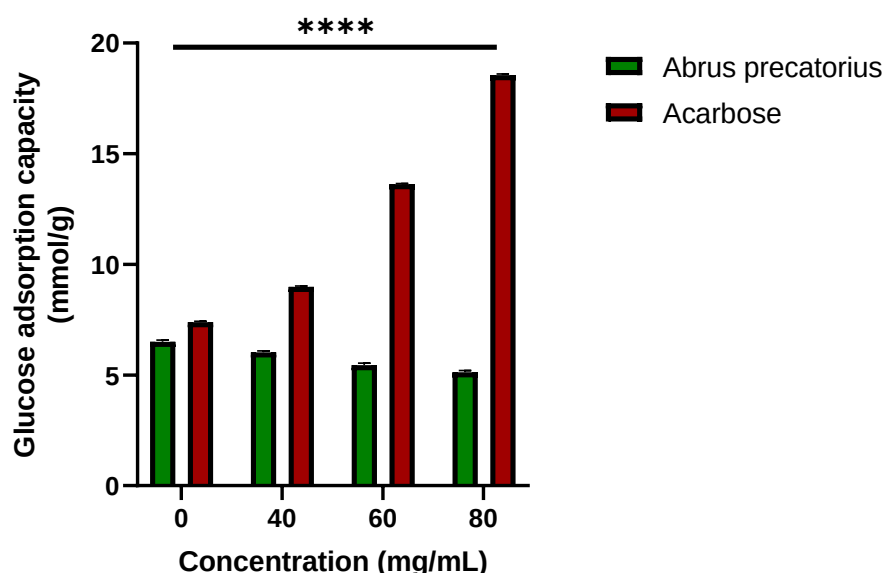


Figure 3. Effect of *Abrus precatorius* leaf extract concentration on glucose adsorption capacity compared with acarbose.

Ferric reducing antioxidant power (FRAP)

The FRAP activity of the *A. precatorius* extract increased progressively with increasing extract concentration (Table 4). The extract showed $33.75 \pm 0.34\%$ activity at 40 mg/mL, increasing to $52.04 \pm 0.30\%$, $64.51 \pm 0.26\%$, and $68.55 \pm 0.25\%$ at 80, 120, and 160 mg/mL, respectively. The differences among the tested extract concentrations were statistically significant ($p < 0.05$). The reference standard, gallic acid, showed higher activity, with values of $72.85 \pm 5.34\%$, $75.63 \pm 4.81\%$, $76.76 \pm 2.85\%$, and $81.68 \pm 4.17\%$ at 10, 20, 40, and 80 mg/mL, respectively. The extract therefore demonstrated increasing reducing activity with concentration, although the values remained below those recorded for gallic acid at the corresponding tested concentrations.

Table 4. FRAP activity of *Abrus precatorius* extract and gallic acid at different concentrations.

Concentration (mg/mL)	<i>A. precatorius</i> (% activity)	Gallic acid (% activity)
0	0.00 ± 0.00^a	—
10	—	72.85 ± 5.34
20	—	75.63 ± 4.81
40	33.75 ± 0.34^b	76.76 ± 2.85
80	52.04 ± 0.30^c	81.68 ± 4.17

120	64.51 ± 0.26^d	—
160	68.55 ± 0.25^e	—

Values are mean $\pm$ SD (n = 3). Different superscript letters indicate significant differences among extract concentration levels according to Duncan's multiple-range test ($p < 0.05$).

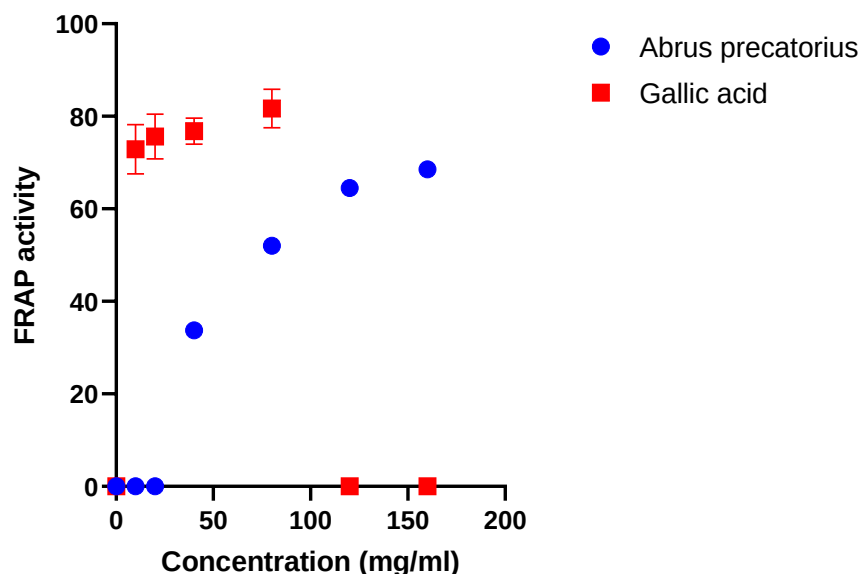


Figure 4. FRAP antioxidant activity of *Abrus precatorius* leaf extract compared with gallic acid.

DPPH radical-scavenging activity

The DPPH radical-scavenging activity of the *A. precatorius* leaf extract increased progressively with increasing concentration (Table 5). The extract exhibited $11.55 \pm 0.65\%$, $40.02 \pm 0.37\%$, $49.40 \pm 3.72\%$, and $54.05 \pm 0.65\%$ scavenging activity at 10, 20, 40, and 80 mg/mL, respectively. Duncan's multiple-range test demonstrated significant differences among the extract concentrations ($p < 0.05$), with each concentration group assigned a different superscript letter. The reference standard, BHT, showed 93.99% inhibition, which was substantially higher than the maximum scavenging activity recorded for the extract at 80 mg/mL.

Table 5. DPPH radical-scavenging activity of *Abrus precatorius* leaf extract and BHT.

Concentration (mg/mL)	<i>A. precatorius</i> (% DPPH scavenging)	BHT (% inhibition)
10	11.55 ± 0.65^a	93.99
20	40.02 ± 0.37^b	—
40	49.40 ± 3.72^c	—
80	54.05 ± 0.65^d	—

Values are mean $\pm$ SD (n = 3). Different superscript letters indicate significant differences among extract concentration levels according to Duncan's multiple-range test ($p < 0.05$).

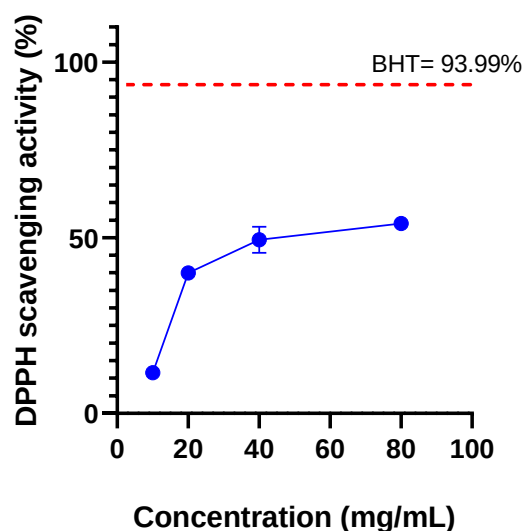


Figure 5. DPPH radical-scavenging activity of *Abrus precatorius* leaf extract compared with BHT.

DISCUSSION

The present study demonstrates that *Abrus precatorius* leaf extract possesses measurable carbohydrate-digestive enzyme inhibitory and antioxidant activities *in vitro*. The extract inhibited both α -amylase and α -glucosidase, with the magnitude of inhibition increasing across the tested concentrations for α -glucosidase and showing a general concentration-related increase for α -amylase. Although the activity was lower than that of acarbose, the response is biologically relevant because inhibition of these enzymes can reduce the rate at which dietary carbohydrates are converted into absorbable glucose. α -Amylase initiates starch hydrolysis, whereas α -glucosidase catalyses the final stage of carbohydrate digestion at the intestinal brush border. Suppression of both enzymatic steps represents an established strategy for limiting postprandial hyperglycaemia.

The present α -amylase and α -glucosidase responses agree closely with the 2021 study of Boye et al., which demonstrated concentration-dependent inhibition of both enzymes by *A. precatorius* leaf extract. That study also reported antidiabetic activity in alloxan/nicotinamide-induced diabetic rats and attributed part of the glucose-lowering effect to noncompetitive inhibition of α -amylase and α -glucosidase. The agreement between the enzyme-level response observed here and the animal evidence reported previously strengthens the biological plausibility of the extract's carbohydrate-digestive enzyme inhibitory activity. The lower potency relative to acarbose is not unexpected because acarbose is a defined pharmacological inhibitor, whereas a crude botanical extract contains multiple constituents present at different concentrations and with different enzyme affinities (Boye et al., 2020). The α -amylase and α -glucosidase inhibition observed in the present study is consistent with recent Nigerian research by Nnaoma et al. (2026), who investigated *Picralima nitida* leaf extract as a potential inhibitor of both carbohydrate-digestive enzymes. The use of a different medicinal leaf species yet targeting the same enzymatic pathways supports the broader potential of Nigerian medicinal plants as sources of enzyme-modulating phytochemicals.

Recent work has expanded the mechanistic basis for the antidiabetic potential of *A. precatorius*. A 2024 study using C2C12 skeletal-muscle cells showed that *A. precatorius* leaf extract increased insulin-stimulated glucose uptake and enhanced expression of insulin receptor substrate-1 and Akt substrate of 160 kDa, implicating the PI3K/Akt signalling pathway in its glucose-regulatory activity. This is important because glucose homeostasis is not determined solely by intestinal carbohydrate digestion; peripheral glucose disposal and insulin sensitivity are also major determinants of circulating glucose (Lankatillake et al., 2024). The enzyme inhibition observed in the present experiment may therefore represent one component of a broader pharmacological profile.

Chemical investigations provide a plausible basis for these activities. LC–HRMS profiling of *A. precatorius* leaves identified 55 putative phytochemicals, with polyphenols, triterpenoids, saponins and alkaloids predominating. Compounds including abrusin, precatorin I, glycyrrhizin, hemiphloin, isohemiphloin and related flavonoid derivatives were identified among the leaf constituents. A separate 2024 investigation specifically associated *A. precatorius* leaf flavonoids with inhibition of α -glucosidase and DPPH radical-scavenging activity, while transcriptomic and network-pharmacology analyses implicated AGE–RAGE and other metabolic pathways in their hypoglycaemic effects (Noor et al., 2022; Yuan et al., 2025). These reports provide a mechanistic context for the enzyme inhibition and antioxidant responses measured in the present work.

The antioxidant assays produced a concentration-related response. DPPH radical-scavenging activity increased from 11.55% at 10 mg/mL to 54.05% at 80 mg/mL, while FRAP activity increased from 33.75% at 40 mg/mL to 68.55% at 160 mg/mL. The progressive increase indicates that higher extract concentrations supplied greater radical-scavenging and reducing capacity under the assay conditions. This behaviour is consistent with earlier biochemical characterisation of *A. precatorius* leaves showing substantial radical-scavenging and ferric-reducing properties. The 2021 antidiabetic study by Boye et al. also reported concentration-dependent DPPH scavenging and increased ferric-reducing antioxidant capacity in the leaf extract. The concentration-dependent increase in DPPH radical-scavenging activity observed for *A. precatorius* leaf extract indicates an enhanced capacity of the extract to neutralise the DPPH radical as extract concentration increased. A comparable concentration-dependent antioxidant response has been reported by Nnaoma and Okeke (2024) in *Platycerium bifurcatum* leaf extract, where DPPH scavenging increased progressively with increasing extract concentration. Their study also demonstrated ferric-reducing activity that increased with concentration, providing a useful comparison with the progressive increase in FRAP activity observed for *A. precatorius* in the present study. The agreement between these observations across two different Nigerian medicinal leaf extracts suggests that concentration-dependent radical-scavenging and reducing activities may be characteristic responses of phytochemical-rich plant extracts. Nnaoma and Okeke (2024) reported measurable phenolic and flavonoid contents in *P. bifurcatum* and an association between these phytochemical constituents and antioxidant activity, supporting the possibility that phenolic and flavonoid constituents contribute to the antioxidant activity observed in the present *A. precatorius* extract.

The antioxidant response may have relevance to diabetes because persistent hyperglycaemia is associated with oxidative stress, although chemical antioxidant capacity cannot be equated directly with antioxidant effects in vivo. The DPPH assay measures the capacity of compounds to neutralise a synthetic radical, whereas FRAP assesses reducing power under specified chemical conditions. The two assays therefore provide complementary rather than interchangeable information. The relatively lower DPPH activity of the extract compared with BHT indicates that the crude extract was less potent than the reference antioxidant under the conditions used, but the progressive concentration-response relationship indicates appreciable radical-scavenging capacity.

Glucose adsorption produced a different pattern. The adsorption value for *A. precatorius* decreased from 6.50 at 0 mg/mL to 5.13 at 80 mg/mL, whereas acarbose increased from 7.38 to 18.55 over the corresponding concentration range. This result does not support a concentration-enhanced glucose adsorption effect for the extract under the experimental conditions. The antidiabetic relevance of the extract is therefore more convincingly supported by its α -amylase and α -glucosidase inhibition and antioxidant activity than by glucose adsorption.

Recent reviews place these observations within a broader pharmacological context, recognising *A. precatorius* as a chemically diverse medicinal plant with reported antidiabetic, antioxidant and other biological activities, while also emphasising the need to consider its toxic constituents (Lankatillake, 2024; Lin et al., 2025). The presence of abrin and related toxic proteins, particularly in the seeds, makes authentication, plant-part selection, extraction method and toxicological evaluation essential when considering therapeutic applications. The present data consequently support *A. precatorius* as a promising source of bioactive compounds with glucose-regulatory and antioxidant potential, but they do not establish

clinical efficacy. Characterisation of the active constituents, determination of enzyme IC₅₀ values and inhibition kinetics, assessment of cellular glucose metabolism, bioavailability studies and controlled in vivo investigations would be required to establish the translational significance of the observed activities.

CONCLUSION

The present study demonstrated that ethanol leaf extract of *Abrus precatorius* possesses measurable in vitro antioxidant and antidiabetic activities. The extract exhibited concentration-dependent DPPH radical-scavenging and ferric-reducing activities, indicating the presence of constituents capable of neutralising free radicals and reducing ferric ions under the experimental conditions. The extract also demonstrated inhibitory activity against α -amylase and α -glucosidase, although its activity was lower than that of the reference drug, acarbose. The progressive increase in α -glucosidase inhibition with increasing extract concentration suggests a concentration-dependent interaction with this carbohydrate-digestive enzyme. The extract also demonstrated glucose adsorption capacity under the tested experimental conditions.

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