Research Article

Phytochemical and Antioxidant Properties of Extracts of *Xylopia aethiopica* Fruits

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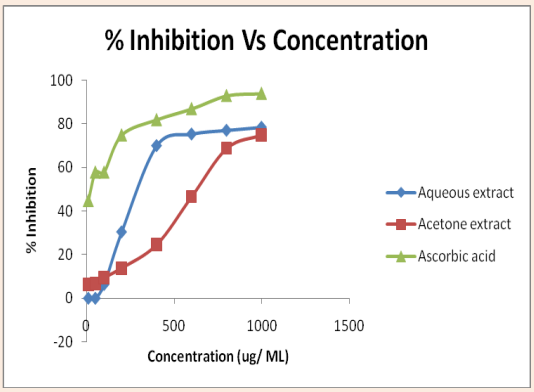
Abstract

This study was carried out to determine the phytochemical and antioxidant properties of extracts of *Xylopia aethiopica* dried fruits. Acetone and aqueous extracts of *X. aethiopica* fruits were investigated for their free radical scavenging activities in the presence of 1,1-diphenyl- 2-picrylhydrazyl (DPPH) using ascorbic acid as positive control. The phytochemical evaluation of the plant extracts was carried out using standard methods. In the phytochemical screening, results showed that both extracts recorded the presence of alkaloids, tannins, flavonoids, glycosides and steroids. The acetone and aqueous extracts of *X. aethiopica* fruits exhibited antioxidant activities in the DPPH assay, with the aqueous extract showing better activity. The antioxidant activity of the two extracts was however, lower than that recorded by the positive control-ascorbic acid. The results however suggest that *X. aethiopica* have potential antioxidant properties which could be exploited in medicine and food industry.



Keywords: *Xylopia aethiopica*, phytochemical property, antioxidant property, DPPH

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Introduction

Xylopia aethiopica, a member of the custard apple family, Annonaceae, is a dense forest understory tree 15-30 m high and 60-75 cm in diameter, growing on river banks or marshland. It has a slender trunk with a buttressed base 50 cm to 1 m in diameter [1]. Its strongly peppery seeds and carpels are used as spices or condiments [2].

The cloves of the plant are used as a spice in various traditional dishes of Western and Central Africa. The plant is also used in decoction to treat dysentery, bronchitis, ulceration, skin infection and female sterility [3].

Several studies have shown that *X. aethiopica* extracts possess antibacterial [4,5,6], antifungal [7] and anti-plasmodial [8] activities. *X. aethiopica* extract has been reported to possess antioxidant activity [9]. Adaramoye *et al.* [10,11] reported that the plant increases antioxidant defense and protects rats from the adverse effects of irradiation. The present study was designed to investigate the antioxidant properties of extracts of *X. aethiopica* fruits by measuring their free radical scavenging properties with the aim of confirming its ethnomedicinal use.

Experimental

Sample collection

X. aethiopia fruits were collected in March, 2014 from Nnewi in Anambra state. They were identified by a plant taxonomist in the Department of Pharmacognosy and Traditional Medicine, Faculty of Pharmaceutical Sciences,

Nnamdi Azikiwe University, Awka, Nigeria. The samples were air-dried under a shade and milled using a mechanical grinder.

Extraction

500 g of the pulverized plant was macerated in 1 Liter of acetone (for 48 hrs) and distilled water (for 24 hrs) respectively. The mixtures were sieved using porcelain cloth and were further filtered using No. 1 Whatman filter paper. The filtrates were concentrated using rotary evaporator and the crude concentrates were then stored at 4^{o}C until required for further experiment.

Phytochemical Screening

In the phytochemical analysis of the extracts of *X. aethiopica* dried fruits, tests for alkaloids, tannins, saponins, flavonoids, steroids, cardiac glycosides, and terpenoids were carried out using standard methods reported by Trease and Evans [12].

***In vitro* free radical scavenging activity of the extract (DPPH Assay)**

The free radical scavenging activity of the extracts of *X. aethiopica* and ascorbic acid was measured with 1,1-diphenyl- 2-picrylhydrazyl (DPPH). A volume of 3 mL of DPPH in methanol solution was added to 100 µL of different concentrations of the samples (10-1000 µg/mL). After 30 minutes, the absorbance of the sample solutions in methanol was measured at 517 nm. The antioxidant activity of the samples was expressed as IC_{50} which was defined as the concentration of the sample that inhibited the formation of DPPH radical by 50 %. Each experiment was carried out in triplicate and the average absorbance was calculated. The percentage inhibition of the samples at the different doses was calculated using the formula:

$$\%\,\text{Inhibition} = \frac{A_o - A_s}{A_o} x100$$

Where A_o is absorbance of control and A_s the absorbance of tested samples.

Results and Discussion

The antioxidant activity of the extracts of *X. aethiopia* was investigated and the results were compared to that of ascorbic acid which was used as the positive control. The results are shown in Figures 1. Also, the result of the phytochemical analysis links the presence of flavonoids and other polyphenols to the antioxidant activities observed. Different levels of the secondary metabolites based on the tests carried out were observed as displayed in Table 1.

Table 1 Result of Phytochemical Analysis of *X. aethiopia* Extracts

	Alkaloids	***Tannins***	***Saponins***	***Flavonoids***	***Cardiac glycosides***	***Terpenoids***	***Steroids***
Acetone extract	++	+	-	+++	+++	+	+
Aqueous extract	+	++	+	++	+	-	++

+++ = Abundantly present; ++ = Moderately present; + = Mildly present; - =Absent

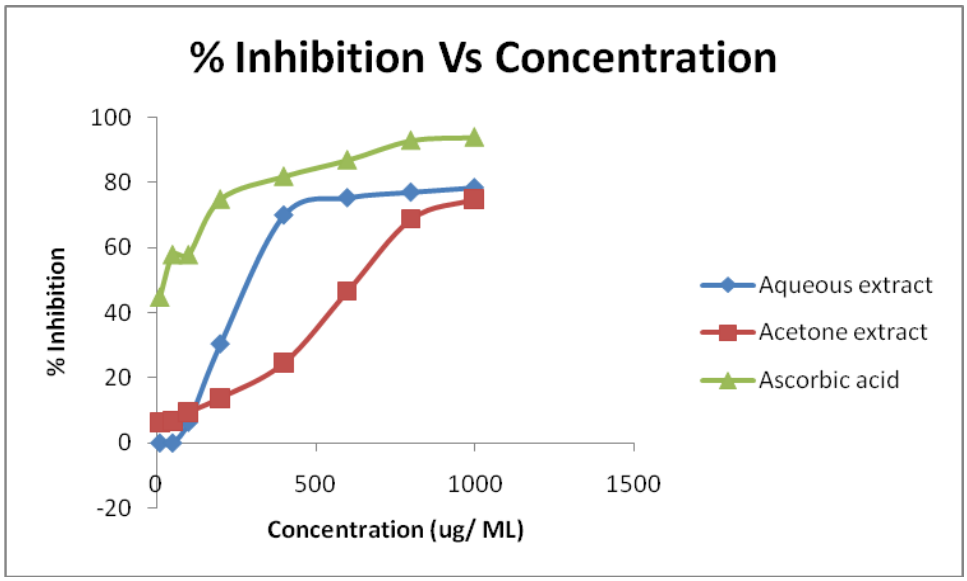

Figure 1 Comparison between free radical scavenging activities of acetone and aqueous extracts of *X. aethiopia* and ascorbic acid determined using DPPH. IC_{50} for aqueous extract=280 µg/mL; acetone extract= 620 µg/mL; ascorbic acid= 30 µg/mL

The results showed that the crude extracts of dried fruits of *X. aethiopia* recorded antioxidant activities. The aqueous extract exhibited highest antioxidant property shown by inhibition of free radical formation by DPPH with an IC_{50} of 280 µg/mL. The acetone extract recorded a lower activity with an IC_{50} of 620 µg/mL (Figure 1).

Previously, antioxidant property of essential oil distilled from the fruits of *X. aethiopia* was found to exhibit significant superoxide scavenging activity [13] and the main constituents reported in the oil was monoterpenes. However, phytochemical analysis carried out on the aqueous and acetone extracts *X. aethiopia* showed no presence of terpenes in the former and a mild presence in the later. The aqueous extract which showed no presence of terpenoids, exhibited the best free radical scavenging activity, while acetone extract with mild presence of terpenes recorded a lower activity. This suggests that different group(s) of secondary metabolites may be responsible for the antioxidant activity observed in these extracts.

In the aqueous extract of the plant, the levels of flavonoids and tannins were moderate and consistent. Flavonoids and tannins are polyphenols which are known to have potent antioxidant properties due to their reducing ability [14]. The phytochemical test also showed that the acetone extract which had lower IC_{50} had more content of flavonoids which are known for remarkable antioxidant properties. The lower activity observed can be explained by the fact that flavonoids only exhibit antioxidant properties if features such ortho-dihydroxy substitution in the B-ring, C2-C3 double bond and a carbonyl group in C-4 of the C-ring are present [15]. Quercetin is a good example of a flavonoid with such structural features and it has a high antioxidant property [16].

Although the free radical scavenging activities observed for the extracts of the plant were not as much as that observed for ascorbic acid which was the positive control, the antioxidant activity of the extracts especially that of the aqueous extract of *X. aethiopia* fruits can be said to be reasonable considering that the extracts were in the crude form. Further purification of the aqueous extract is expected to produce pure compounds with improved antioxidant property.

The results of the study however confirms the works of Karioti *et al.* [9] and Adaramoye *et al.* [10,11] who reported on the antioxidant property of *X. aethiopia.*

Conclusion

The findings of this study reveal that *X. aethiopia* possesses antioxidant property. Considering that *X. aethiopia* has nutritional values and can as well serve as flavourings for food product, the extracts of the plant can be developed with further purification and used as an antioxidant agent in the food industry, as well as in medicine.

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