

Antioxidant Capacity and Antibacterial Activities of Leaf Extract of *Adansonia digitata*

¹Oduşina Babatope Oluseun, ¹Chibuikem Chidimma Mary and ²Osiboye O.O

¹Department of chemical science, Tai Solarin University of Education, Ijagun, Ijebu ode, Ogun state, Nigeria.

² Department of chemistry, Tai solarin college of education, omu, ijebu ode

ABSTRACT

This research work investigated the antioxidant and antibacterial activities of the leaves of *Adansonia digitata* L. malvaceae (Baobab tree) to justify its use in traditional medicine practice. The leaf extract of *Adansonia digitata* (Baobab tree) was evaluated for antioxidant and antibacterial activities using 2,2-diphenyl-1-picrylhydrazyl (DPPH) method and the disc diffusion method respectively. The extract was also screened for the presence of phytochemicals. At concentration of 0.062 mg/ml, the leaves extract displayed high free radical scavenging activities. The extract was also active against all the tested bacteria but inactive against fungi at concentration of 200 to 100 mg/ml. Preliminary phytochemical tests revealed the presence of flavonoids, alkaloid and saponins. This study revealed that *Adansonia digitata* is a good source of antioxidants and also justifies the use of this plant in the treatment of fever, dysentery, diarrhea, inflammatory ulcers and diuretic activities due to its antibacterial activities.

Keywords: Antimicrobial, Antioxidant, *Adansonia digitata*, DPPH, Disc diffusion

INTRODUCTION

Mediterranean diet which is rich in natural antioxidants leads to limited incidence of cardiovascular diseases. Antioxidants constituents of plants act as radical scavengers and helps in converting free oxygen radicals that are responsible for cardiovascular diseases to less reactive species (Liyan *et al.*, 2002). Natural antioxidants present in foods have attracted considerable interest because of their presumed safety and potential nutritional and their therapeutic effects (Sulekha *et al.*, 2009). Because extensive and expensive testing of food additives is required to meet safety standards, synthetic antioxidants have generally been eliminated from many food applications. The increasing interest in the search for natural replacements for the synthetic antioxidants has led to the antioxidant evaluation of a number of plant sources (Sulekha *et al.*, 2009). *Adansonia digitata* L. belongs to the family malvaceae. It is a tree revered in Africa for its medicinal and nutritional value. It is used to treat diarrhoea, malaria and microbial infections. It is used as a forage for ruminants in dry season. (Lockett *et al.*, 2000). The bark has astringent properties and has been used traditionally to alleviate colds, fevers. The leaves may be used as an antiperspirant and they may also have been used to treat fever, kidney and bladder diseases. (Sulaiman *et al.*, 2011). It is also used as a forage for ruminants in dry season (Deshmukh *et al.*, 2013). *Adansonia digitata* L. is highly valued for a variety of food and artisanal uses and for its cultural symbolism extending over millennia (Kamatou *et al.*, 2011). The fruit has anti-inflammatory, febrifuge and analgesic properties

due to the presence of saponins and sterols and contains astringent compounds (tannins, cellulose) which exert an antidiarrhetic action due to its osmotic effect and an inhibitory interaction with acetylcholine, the neurotransmitter that is responsible for gut spasms (Vertuani, 2002).

MATERIALS AND METHODS

Materials: Whatman No. 1 filter paper, DPPH, methanol, ascorbic acid, Agar solution, gentamicin, Molten Sabour Dextrose Agar (SDA), Ticonazole, hydrochloric acid, Dragendoff reagent, chloroform, H₂SO₄ distilled water, Ferric chloride reagent, Fehling solution A and B, benzene, aqueous H₂SO₄

Methods: The leaves of the plant *Adansonia digitata* were collected in Ibadan, Oyo State. The leaves of *Adansonia digitata* were plucked and air dried. The leaves were then pulverized. Methanol was used as extraction solvent. Maceration method of extraction was used. The pulverized leaves were soaked with methanol for 3 days. The mixture was decanted. The resulting solvents were distilled and crude extracts recovered

Preparation of Crude Extract

The plants material was air dried at room temperature for 72 hours, pulverized into powdered form and a portion (100 g) of the material was extracted in methanol at room temperature for 24 hours. Extract was filtered through Whatman No. 1 filter paper and the filtrate evaporated into dryness at 40^o C using rotary evaporator.

Corresponding Author: E- mail: believetng@yahoo.com

Determination of DPPH Radical Scavenging Capacity

The effect of the extract on DPPH radical was estimated adopting the method of Liyana *et al.*, (2002). A solution of 0.135 mL DPPH in methanol was prepared and 1.0 mL of this solution was mixed with 1.0 mL of extract in methanol containing 0.02-0.1 mg of extract. The reaction mixture was vortexed thoroughly and left in the dark at room temperature for 30 min. The absorbance of the mixture was measured spectrophotometrically at 517 nm. Ascorbic acid was used as standards. The ability to scavenge DPPH radical was calculated by the following Eq:

$$\text{DPPH radical scavenging activity (\%)} = \frac{(\text{Abs}_{\text{control}} - \text{Abs}_{\text{sample}})}{(\text{Abs}_{\text{control}})} \times 100$$

Where,

$\text{Abs}_{\text{control}}$ = Absorbance of DPPH radical + methanol

$\text{Abs}_{\text{sample}}$ = Absorbance of DPPH radical + sample extract/standard

Antibacterial Testing

Agar diffusion method (antibacterial assay): An overnight culture of each organism was prepared. 0.1 ml of each organism was taken into 9.9 ml of sterile distilled water to give 10 ml at 1:100 (10^{-2}) dilution from 10^{-2} dilution. 0.2 ml was taken into sterile molten nutrient agar at 45°C. This was aseptically poured into the sterile plates and allowed to set in the bench for about 45 minutes. Concentrations of 200 to 6.25 mg/ml of sample extracts were prepared.

A sterile cork-borer was used to create wells/holes inside the set plate. In the wells, different prepared concentrations of the sample were introduced. All the concentrations were introduced into the wells with negative and positive control. Concentration of 10 mg/ml of gentamicin was used as positive control for bacteria. These were allowed to stay on the bench for two hours before incubation at 37°C for 18 – 24 hrs (Grierson and Afolayan, 1999).

Surface plate method was used for antifungal assay. Molten Sabour Dextrose Agar (SDA) was poured

aseptically in the sterile plates, allowed to cool and set for about 45 mins. Then 0.2 ml of 1:100 dilution of the organism was spread on the surface using a sterile spreader. Then a sterile cork borer was made to create wells inside the set plate. Ticonazole was used as Positive control for fungi. All these plates were then incubated at 20 – 26°C for 48 hours (Afolayan and Meyer, 1997).

Phytochemical Screening

- Test for Saponins

About 0.5 g of extract was shaken with water in a test tube. Observation of frothing was indicative of the presence of saponins.

- Test for Alkaloids

About 0.5 g of the extract was stirred with 5 ml of 10 % aqueous hydrochloric acid on a steam bath. 1 ml of the filtrate was treated with a few drops of Dragendoff reagent. Observation of a precipitate was indicative of presence of alkaloids.

Test for steroids

0.5 g of the extract was dissolved in 2 ml of chloroform. H_2SO_4 was carefully added. The formation of a reddish brown colour interphase was a positive test for steroids.

- Test for Tannins

About 1 g of the extract was stirred with 10 ml of distilled water, warmed and filtered. Ferric chloride reagent was added to the filtrate. The formation of blue-black precipitate was indicative of the presence of tannins.

- Test for reducing sugar

A small portion of extract was dissolved in distilled water and warmed with Fehling solution A and B. Observation of red precipitate was a positive test for reducing sugar.

- Test for Anthraquinones

2 g of methanol extract was shaken with 5ml benzene, filtered and 10 ml aqueous H_2SO_4 was added to the filtrate. The mixture was shaken. Observation of pink, red or violet colour was indicative of anthraquinone.

RESULTS AND DISCUSSION

Table 1:Antimicrobial screening of the leaves extract of *Adansonia digitata*

Concentration	Inhibition zone(mm)					
Mg/ml	<i>Staphylococcus aureus</i>	<i>Escherichia coli</i>	<i>Bacillus subtilis</i>	<i>Pseudomonasaeruginosa</i>	<i>Salmonella typhi</i>	<i>Klebsiella pneumoniae</i>
200	14	12	16	16	12	12
100	12	10	14	14	10	10
50	10	-	12	10	-	-
25	-	-	10	-	-	-
12.5	-	-	-	-	-	-
6.25	-	-	-	-	-	-
+ve	38	40	38	40	38	36

Table 2: Antioxidant activities of leaves Extract of *Adansonia digitata*

CONCENTRATION mg/mL	ABSORBANCE (nm)			
	Sample	Ascorbic Acid	Scavenging Activity %	
			Sample	Ascorbic acid
1.0	1.238	0.406	51	44
0.5	0.722	0.420	71	42
0.25	1.295	0.520	48	29
0.125	0.931	0.560	63	23
0.625	0.588	0.580	77	21

Table 3 : Phytochemical screening of leaves extract of *Adansonia digitata*

Phytochemicals	Present
Alkaloid	+
Flavonoid	+
Saponin	+

The result in table 1 showed that the methanol extract was active against bacterial only at concentration of 200 to100 mg/ml. At concentration of 25 mg/ml, it was active against *Bacillus subtilis* only. At concentration of 1 mg/ml to 0.625 mg/ml, the free radical scavenging activity of the methanol extract of the leaves of *Adansonia digitata* showed more activity than the standard ascorbic acid used as shown in the result in table 2. The result in table 3 revealed the presence of alkaloid ,flavonoid and saponin from the phytochemical screening.The free radical scavenging activity of the methanol extract of the leaves indicates that *Adansonia digitata* is a good source of antioxidant. Previous work done on the fruit pulp of *Adansonia digitata* indicated that it is a valuable source of vitamin C. The red funicles of the fruit have an impressive antioxidant capacity (Vertuani,2002).This research showed that the leaves of *Adansonia digitata* also have an impressive antioxidant capacity. This plant therefore will aid in the prevention of degenerative

diseases like cancer and tumour if consumed since antioxidants have been implicated in the prevention of these diseases.These phytochemicals have reported bioactivities, they have a pronounced action on nervous system thereby producing physiological and psychological results, possess wound healing activities and also reduces blood pressure. The antimicrobial activity of the leaves extract of *Adansonia digitata* against diseases causing microorganisms may be responsible for the medicinal uses of this plant. Most antibiotics have lost their effectiveness due to development of resistant strains.

CONCLUSION

The result of this research study has justified the use of the plant for the treatment of infectious diseases caused by bacteria and fungi. The study also suggests that leaves of *Adansonia digitata* may be utilized as a safe natural source for antioxidant and antimicrobial agents.

REFERENCES

- Afolayan, A.J. and Meyer J. M. (1997) The antibacterial activity of 3,5,7 – trihydroxyflavone isolated from the shoots of *Helichrysum aureonitens*. *Journal of Ethnopharmacology.*, 57: 177-181
- Deshmukh S. Katare Y, Shylae S. Bhubal S.(2013). Phytochemical and medicinal uses of *Adansonia digitata*.*Journal of Phramaceuticals*. 6(1). Pp 267-289.
- Liyana, Y.H., Scott M, M. Jonathan W. and Q. Minq, (2002) Free radical scavenging properties of wheat extracts. *Journal of Agriculture and Food Chemistry*. 50:1619-1624.
- Lockett C.T, Calvert C.C. Grivetti L.E.(2000).Energy and micronutrient composition of dietary and medicinal wild plant consumed during drought. Study of rural Fulani north eastern ,Nigeria. *International Journal of Food sciences and nutrition*.51(3):195-208.
- Kamatou GPP, Vermaak I, Viljoen AM. (2011). An updated review of *Adansonia digitata*, a commercially important African Tree. *South African Journal of Botany* 77, 908-919.
- Sulaiman L.K., Oladele O.A, Shittu I.A, Emilepe B.O, Oladokun A.T .Meseko A. (2011). In ovo evaluation of the antiviral activity of methanolic root bark extract of the African baobab (*Adansonia digitata*).*African Journal Of Biotechnology*:10(20):4256-4258
- Sulekha M.Satish Y Sunita Y. Rajesh k.(2009).Antioxidants. A review. *Journal of chemical and pharmaceutical research*.1(1)102-104.
- Vertuani S, Braccioli E, Buzzoni V, Manfredini S. (2002). Antioxidant capacity of *Adansonia digitata* fruit.*Acta Phytotherepeutical*.2.Available at :www.baobabfruit.co/pdf/2008/2003-02.Actaphyterantioxidant.pdf.accessed October 21,2015.