Total Phenolics Content/Antioxidant Potential of 8 Selected Plants in Southern Nigeria

Ruth Goodluck Elefe[1]*

[1]Department of Pharmaceutical and Medicinal Chemistry, Faculty of Pharmaceutical Sciences, University of Nigeria, Nsukka, Nigeria.

ABSTRACT

In modern times, foods rich in phenolics and flavonoid from natural sources with antioxidant properties have gained serious attention in the nutrition and food science world, hence the purpose of this research was to investigate the phenolic content of the leaves of (*Vernonia amygdalina, mangifera indica, denneltia tripetala, azadirachta indica, citrus sinensis, chromoalaena odorata, anacardium occidentale, telferia occidental*) obtained from the southern part of Nigeria. The phenolic content was determined using the Folin-Ciocaltean reagent and their various absorbances were read at 750nm using a spectrophotometer. From the results obtained, *Mangifera indica* exhibited the highest phenolic content with a concentration of (31.49mg/g) Gallic Acid Equivalent (GAE) and hence has the highest potential of antioxidant activity while the least phenolic content concentration was recorded from *Denneltia tripetala* with a concentration of (3mg/g) GAE amongst the plant samples studied. In this study, the evaluation of total phenolics in these plants suggests that edible leaves of some plants with high phenolic values can be an important source of natural antioxidants for the possible reduction or prevention of lethal oxidation in nutraceuticals or medicines for the management of illnesses associated with free radicals.

Key Words: *Phenolic content, Gallic acid equivalent, Antioxidants, Concentration*

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INTRODUCTION

Plants that are of medicinal importance produce quite a lot of secondary metabolites which are of value in the production of pharmaceuticals [1, 2]. Some of the metabolites include phenols, flavonoids, saponins, tannins, alkaloids and sterols. The quantity and quality of these secondary metabolites differ appreciably in the different parts of the plant [3, 4].

Naturally occuring phenolic and flavonoid compounds are plant secondary metabolites with an aromatic ring having at least one hydroxyl group [5, 6]. The electron-donating property of phenolic compounds could directly explain their antioxidant activity potential [6]. Going by the several reports in the literature, phenolic compounds demonstrate free radical prevention, peroxide decomposition, metal inactivation or oxygen scavenging in biological systems and help hamper oxidative illness burden [6, 7].

In modern times, foods rich in phenolics and flavonoid from natural sources with antioxidant properties have gained serious attention in the nutrition and food science world [6, 8].

Phenolics (phenolic compounds) are the utmost prominent plant secondary metabolites, with various physiological functions in plants as a result of their antioxidant features having positive impacts on human health. The presence of phenolic compositions in some plants is mainly responsible for their antioxidant activity [4, 9-11]. Naturally occurring antioxidants that are found in plants help in scavenging free radicals that are harmful to the body, thereby reducing the depletion of free radicals whose presence can lead to serious pathological status and also hasten the course of aging [4].

The purpose of this research was to investigate the phenolic value and antioxidant potential of the leaves of (*Vernonia amygdalina*, *mangifera indica*, *denneltia tripetala*, *azadirachta indica*, *citrus sinensis*,

Corresponding author: Ruth Goodluck Elefe
Address: Department of Pharmaceutical and Medicinal Chemistry, Faculty of Pharmaceutical Sciences, University of Nigeria, Nsukka, Nigeria.
E-mail: ✉ ruth.elefe.pg76968@unn.edu.ng
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chromoalaena odorata, anacardium occidentale, telferia occidental) obtained from the southern part of Nigeria.

MATERIALS AND METHODS

Materials

Plant samples

Vernonia amygdalina, mangifera indica, denneltia tripetala, azadirachta indica, citrus sinensis, chromoalaena odorata, anacardium occidentale, telferia occidental. The plants botanical and common names are given in **Table 1** below.

Table 1. Plants Botanical and Common Names

Botanical names	Common names
Vernonia amygdalina	Bitter leaf
Mangifera indica	Mango
Denneltia tripetala	Pepper fruit
Azadirachta indica	Neem (dogoyaro)
Citrus sinensis	Orange
Chromoalaena odorata	Awolowo
Anacardium occidentale	Cashew
Telferia occidental	Pumpkin

Reagents

Methanol, gallic acid, distilled water, Folin-Ciocaltean reagent, Na_2CO_3. All reagents and solvents used were of pure quality and analytical grade.

Methods

Sample collection

Fresh leaves of the various plant samples were collected at various locations within Esan West local government region of Edo state, Nigeria and identified by a botanist in the Department of Botany, University of Nigeria, Nsukka.

Sample preparation

5g of the leaf of each of the plant samples was weighed, crushed to form a paste and thereafter poured into separate containers with lids. 100ml of methanol was added to the crushed samples, stirred with a spatula to increase even distribution and enhance extraction. The mixture was left 24 hours for proper extraction, thereafter the sample solution was filtered with a funnel and filter paper, then 0.1ml of the filtrate was measured into 2 separate test tubes with the use of a dropping pipette, the test tubes were held over boiling water to drive out the methanol used for extraction, leaving a concentrated and dry sample extract in the test tubes.

Vehicle preparation and use

Solutions of gallic acid and Folin-Ciocaltean reagent were bought already prepared while 7% Na_2CO_3 was prepared by dissolving 7g of Na_2CO_3 in 100ml of distilled water.

Distilled water was used to prepare Na_2CO_3 and also used for dilution of the blank or control.

Gallic acid was applied as a standard to determine the presence of phenolics.

Folin-Ciocaltean reagent and 7% Na_2CO_3 were used to estimate the total phenolic content.

Analysis

Each plant sample was analyzed using 8 test tubes, 2 of which (X_1, X_2) contained the plant extract and the other 6 served as blank or control. 0ml, 0.1ml, 0.2ml, 0.3ml, 0.4ml and 0.5ml of gallic acid (1mg/ml) were added to the 6 blank or control test tubes respectively. No gallic acid was added to the test tubes containing the concentrated extract. Distilled water was added to all 8 test tubes (X_1, X_2 and the 6 control test tubes) to make each of them up to 3.6ml. Since different volumes of gallic acid was added to the 6 control test tubes and diluted to 3.6ml, it implies a change in the concentration of the gallic acid contained in each test tube, therefore by calculations, the new concentration of gallic acid after dilution becomes; 0.0mg/ml, 0.2mg/ml, 0.4mg/ml, 0.6mg/ml, 0.8mg/ml, 1.0mg/ml respectively for the 6 control test tubes. 0.4ml of Folin-Ciocaltean reagent was added to all (8) test tubes and the mixture was allowed to stand for 5 minutes, after which 4ml of 7% Na_2CO_3 was added to all (8) test tubes and the mixture was allowed to stand for 90 minutes after which their various absorbance were read at 750nm using a spectrophotometer (Shimadzu double beam UV 210A). The phenolic content of all the plant samples analyzed were determined using the procedure described above in duplicates and the results were calculated with help of the calibration curve of the gallic acid.

RESULTS AND DISCUSSION

The tables below shows the absorbance values obtained from varying concentrations of Gallic Acid, and the phenolic content values present in the plant samples. **Table 2** contains concentration of the Gallic Acid after dilution and their various absorbance values while **Table 3** contains total phenolic content present in plant samples in (mg/ml) and (mg/g).

Table 2. Concentration of the Gallic Acid after Dilution and their Various Absorbance Values

Test tubes	Concentration (mg/ml)	Absorbance
1	0	0.000
2	0.2	0.284
3	0.4	0.494

4	0.6	0.715
5	0.8	0.962
6	1.0	1.138

Table 3. Total Phenolic Content Present in Plant Samples in (mg/ml) and (mg/g)

Samples	Total phenolic content		Average phenolic content	
	X_1	X_2	Extract (mg/ml)	Sample (mg/g)
Vernonia amygdalina	0.145	0.967	0.556	11.12
Mangifera indica	1.567	1.582	1.575	31.49
Denneltia tripetala	0.160	0.140	0.150	3.0
Azadirachta indica	0.457	0.539	0.498	9.96
Citrus sinensis	0.40	0.427	0.414	8.27
Chromoalaena odorata	0.525	0.500	0.513	10.25
Telferia occidental	0.183	0.199	0.191	3.82

Total phenolic content is the procedure to figure out the number of phenolics present in a particular plant sample. Phenolic compounds that are contained in the plants possess redox properties, and these properties make them act as antioxidants [12, 13].

From the results presented in **Table 2** above, *Mangifera indica* exhibited the highest phenolic content with a concentration of (31.49mg/g) Gallic Acid Equivalent (GAE) and hence has the highest potential of antioxidant activity amongst the plant samples studied, followed by *Vernonia amygdalina* with a phenolic concentration of (11.12mg/g) GAE, *Chromoalaena odorata* (10.25mg/g) GAE, *Azadirachta indica* (9.96mg/g) GAE, *Citrus sinensis* (8.27mg/g) GAE, *Telferia occidental* (3.82mg/g) GAE and the least phenolic content concentration was recorded from *Denneltia tripetala* with a concentration of (3mg/g) GAE. *Anacardium occidentale* was out of range.

The results from these studies correlate with reports from previous studies. Johnson *et al*. reported the gallic acid equivalent of *Vernonia amygdalina as 14.9* (mg/g dry weight) [14], 10.80 mg/g GAE OF dried Azadirachta indica leaves [15] and 20.80 mg/100 g to 107.29 mg/100 g of the powder crude extracts obtained from different stems ranged from [16]. Rao *et al*. reported the total phenolic content of the chloroform extract of *chromolaena odorata* as 242.2 mg/g [17].

CONCLUSION

In this study, *Mangifera indica* exhibited the highest phenolic content with a concentration of (31.49mg/g) Gallic Acid Equivalent (GAE) and hence has the highest potential of antioxidant activity amongst the plant samples studied. The evaluation of total phenolics in these plants suggests that edible leaves of some plants with high phenolic contents such as that observed in *Mangifera indica* in this study can be an important source of natural antioxidants. Chosen plants with high antioxidant activity may be projected for preventing lethal oxidation in nutraceuticals or medicines for the treatment of illnesses related to free radicals. Further research into the separation and detection of the exact compounds responsible for the antioxidant activity and their mechanism of action is needed to give a better understanding of their possible ability to control illnesses that have an important effect on the quality of life.

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