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EVALUATION OF PHYTOCHEMICAL CONSTITUENT, PROXIMATE AND ANTIOXIDANT STATUSOF AFRICAN STAR APPLE (*CHRYSOPHYLLUMALBIDUM*.) LEAVES, BARK AND ROOT

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ABSTRACT

Numerous bioactive compounds have been reported to be present in African star Apple (Chrysophyllumalbidum)which have been linked to the ethno medicinal properties of the plant. The present work was designed to determine the phytochemical constituents, proximate analysis and the antioxidant value of African star Apple (Chrysophyllumalbidum). The samples were collected from rainforest in Okenugbo Via Ago-Iwoye, Ogun state, and solvent extraction was done using maceration with aqueous and kept inside refrigerator at 4^{o}C for further analyses. The proximate analysis of the leaves, bark and root extracts of African star Apple (Chrysophyllumalbidum.) shows the presence of moisture, Ash, Crude fibre, Fat, Protein and Carbohydrate with values 36.7±0, 27.1±0, 28.21±0; 5.6±0, 8.4±0, 2.6±0; 10.75±0.05, 10.51±0.01, 11.7±0; 1.5±0, 2.6±0, 0.31±0; 17.3±.0, 17.45±0, 9.3±0; 28.24±0.04, 34.03±0.03, 47.9±0respectively. The phytochemical analysis of the leaves bark and root extracts of African star Apple (Chrysophyllumalbidum.) revealed presence of flavonoid, alkaloid, Saponin, tannin, phenol, phyta oxalate and glycosides with values 7.11±0.5, 6.00±0, 6.1±1.09; 8.11±1, 7.60±0.4, 6.33±0.03; 4.20±0.1, 3.22±0, 3.44±0.1; 1.1±0.1, 0.90±0.05, 0.79±0; 3.22±0.92, 2.51±0.01, 1.92±0.02; 3.20±0, 5.62±0.02, 6.12±0.02; 1.17±0.02, 0.81±0.01, 0.90±0; 592.1±0.09, 307.22±0, 413.52±0.02respectively. The antioxidant activity of African star Apple (Chrysophyllumalbidum) (leaves, bark and root) revealed the minimum (25.11±0.01) and maximum (60.59±0.02), minimum (20.86±0.02) and maximum (55.23±0.01) minimum (17.8±0) and maximum (50.92±0.01) capacity of scavenging free radicals of the samples respectively. This research revealedthat (Chrysophyllumalbidum.) considered as a potential candidate for fodder additive and potent medicinal plant as a result of the properties present in the leaves, bark and root.

Keywords: Medicinal plants, proximate, *Chrysophyllumalbidum*, Phytochemicals, antioxidants

INTRODUCTION

Most of the world's population in developing countries depends on herbal medicines to meet their health needs. Herbal medicines are often used to provide first-line and basic health services, both to people living in rural areas where it is the only available health service, and to people living in poor areas where it offers the only affordable remedy (Uzoekwe and Mohammed, 2015).It is a well-established fact that fruits, herbs and spices rich diets are associated with low risks of many ailments (Dandare *et al.*, 2017). *Chrysophyllumalbidum*is a typical ever green edible fruit tree. It belongs to the family Sapotaceae and is common throughout the tropicalCentral, East and West Africa regions for its sweet edible fruits and ethno-medical uses (Orijajogun *et al.*, 2013). The African star apple tree is about 8-36cm in height and the fruit is

seasonal (December –April). Medicinal plants are used as sources of therapeuticagents due to the presence of secondary metabolites and also their reduced cost, relative lower incidence of adverse reactions compared to modern synthetic pharmaceuticals (Oluwole *et al*., 2017)). Despite the aforementioned studies/ findings, little attention has been given to investigatingthe antioxidant activity of the edible leave, root and bark of *C. albidum*which is widely relished. Antioxidantsare agents that inhibit the production or counteract the damaging effect of free radicals such as reactive oxygen species (ROS) in the biological system. Therefore, this study was aimed at investigating the phytochemical constituents, proximate analysis and the antioxidant valueof*C. albidum*leave, root and bark.

METHODOLOGY

Sample Collection

Leave, bark and root samples of (*Chrysophyllumalbidum*) were collected from a rainforest in Okenugbo Via Ago-Iwoye,Ijebu-north local government,Ogun state, Nigeria and properly identified at the Polytechnic Ibadan, Botanical Garden. The samples were air dried for six days at room temperature (6days). The dried samples were ground into power with an electric grinder and stored in a dissector prior to analysis.

Phytochemical Analysis

Phytochemical Analysis: The Phytochemical screening was carried out on the plant samples to test for saponins, Steroids, Alkaloids, Glycosides, Flavonoid, Phenol, Tannin and Oxalate using standard method described by (Muhammad and Umar, 2015Sahira and Cathrine, 2015; Velavan, 2015; Ajiboye *et al.*, 2018;Irabor*et al.*, 2020;). The phytochemical screening of the plant extract was carried out in order to elucidate the chemical constituents (bioactive agents) responsible for their antimicrobial and therapeutic activities.

Proximate Analysis

The proximate analysis of the samples for moisture, ash, fibre and fat were done by the method of AOAC (2005). The nitrogen was determined by micro-Kjeldahl method as described by Pearson (1976) the percentage Nitrogen was converted to crude protein by multiplying. All determinations were performed in triplicates.

Determination of antioxidant activity (AOA): The air-dried samples were weighed into 5 mg portions using a weighing balance (Mettler Toledo.XP 105 Delta Range) into separate eppendorf tubes. 1.0 ml of methanol was then added to each sample, vortexed (Vortex V-1 Plus BM BIO) and then sonicated (Astrason TM Ultrasonic Cleaner Model) for 2 h. The solution was decanted and the supernatant hereafter referred to as fruit extract, used for the AOA determinations by the DPPH assay according to Ghasemi *et al.* (2009). The DPPH assay is fairly simple and quick to use and has been widely used in assessing the AOA of foods (Pisoschi et al., 2009; Sharma and Bhat, 2009). It also has the ability to efficiently measure the total AOA of the substrate (under study) without necessarily being specific to any particular antioxidant present (Prakash et al., 2001; Sharma and Bhat, 2009). The results were expressed as percentage inhibition of the DPPH radical which was calculated according to the equation:

$$\%\ DPPH = \frac{Absorbance\ of\ blank - Absorbance\ of\ extract}{Absorbance\ of\ blank} \times 100$$

Where, Absorbance of blank is the absorbance of DPPH solution without extracts. All determinations were carried out at least in duplicates.

Determination of Antioxidant Activity by Hydrogen Peroxide Scavenging Activity

The antioxidant activity of the crude extract of the fruit was measured by the hydrogen peroxide scavenging activity following the protocol described earlier by Kumari and Parida (2016). Hydrogen peroxide scavenging activity (%) was plotted against

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various concentrations of methanolic extract for the calculation of IC50:

Statistical analysis: All extractions and analysis were performed in triplicates. Results were expressed as mean±S.D. (standard deviation).

RESULTS

The phytochemical screening of chemical constituent of **African star apple ((***Chrysophyllumalbidum*)leaves and root extract is shown in Table 1. The results revealed the presence of bioactive compounds; flavonoid, alkaloid, Saponin, tannin, phenol, phytate, oxalate and glycosidesTable 2 showed the results of the proximate analysis of **African star apple** (*Chrysophyllumalbidum*) leaves, root and bark extracts. The results revealed the presence of Moisture, ash, crudefibre, fat, protein and carbohydrate. Table 3 showed the antioxidant value

Table 1: Phytochemical constituents of *Chrysophyllumalbidum*

SAMPLE ID	FLAVONOID	ALKALOID	SAPONIN	TANNIN	PHENOL	PHYTATE	OXALATE	GLYCOSIDE
ASAL	7.11±0.5	8.11±1	4.20±0.1	1.1±0.1	3.22±0.92	3.20±0	1.17±0.02	592.1±0.09
ASAB	6.00±0	7.60±0.4	3.22±0	0.90±0.05	2.51±0.01	5.62±0.02	0.81±0.01	307.22±0
ASAR	6.1±1.09	6.33±0.03	3.44±0.1	0.79±0	1.92±0.02	6.12±0.02	0.90±0	413.52±0.02

ASAL=African Star Apple LeafASAB =African Star Apple BarkASAR =African Star Apple Root

Table 2: Proximate analysis of *Chrysophyllumalbidum*

SAMPLE ID	MOISTURE %	ASH %	FIBRE %	FAT %	PROTEIN %	CARBOHYDRATE %
ASAL	36.7±0	5.6±0	10.75±0.05	1.5±0	17.3±.0	28.24±0.04
ASAB	27.1±0	8.4±0	10.51±0.01	2.6±0	17.45±0	34.03±0.03
ASAR	28.21±0	2.6±0	11.7±0	0.31±0	9.3±0	47.9±0

ASAL=African Star Apple LeafASAB =African Star Apple BarkASAR =African Star Apple Root

Table 3: Antioxidant composition value of *Chrysophyllum albidum* **leaf, bark and root**

SAMPLE ID	DPPH(%)	H_2O_2(mg/ml)
AFRICAN Star apple LEAF	60.59±0.02	25.11±0.01
AFRICAN Star apple BARK	55.23±0.01	20.86±0.02
AFRICAN Star apple ROOT	50.92±0.01	17.8±0

L=Leaf B= Bark R=Root

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DICUSSIONS

The results of phytochemical screening of the leaves and the root extracts of **African star apple (*Chrysophyllumalbidum*)**results revealed the presence of bioactive substance ; flavonoid, alkaloid, Saponin, tannin, phenol, phytate, oxalate and glycosides ranging were*7.11±0.5, 6.00±0, 6.1±1.09; 8.11±1, 7.60±0.4, 6.33±0.03; 4.20±0.1, 3.22±0, 3.44±0.1; 1.1±0.1, 0.90±0.05, 0.79±0; 3.22±0.92, 2.51±0.01, 1.92±0.02; 3.20±0, 5.62±0.02, 6.12±0.02; 1.17±0.02, 0.81±0.01, 0.90±0; 592.1±0.09, 307.22±0, 413.52±0.02*. Results obtained were comparable to the results obtained by Adegbesan, (2019) for the extracts of ***Chrysophyllumalbidum*** leaves, bark and stem. Similar to Bakari*et al*., 2017. The presence of phytochemicals such as saponins, cardiac glycosides, flavonoids, phenols and tannins in *Chrysophyllumalbidum*. reported in this study suggests its use as a medicinal plant, which is in consonance with the medicinal properties of secondary metabolites of selected plants (Olanipekun*et al.*, 2012). The abundance of alkaloids and flavonoids in the root and bark is an indication of its antioxidant effect, and thus supports its reported pharmacological activities (Abu *et al*., 2018; Enin*et al*., 2021).

The proximate analysis results revealed that *Chrysophyllumalbidum* are a good source of mineral elements as they contained a high percentage of ash. Moisture content is in the range of *36.7±0, 27.1±0, 28.21±0; 5.6±0, 8.4±0, 2.6±0; 10.75±0.05, 10.51±0.01, 11.7±0; 1.5±0, 2.6±0, 0.31±0; 17.3±.0, 17.45±0, 9.3±0; 28.24±0.04, 34.03±0.03, 47.9±0 respectively*. This indicated that the leaves and the root are good for formulating because low moisture content prevented microbial growth. The plant sample of *Chrysophyllumalbidum* also appeared to be a good supplement for protein, carbohydrate and fat, which are the major building blocks of nutrition (Olanipekun *et al.*, 2012). Leaves also could provide high energy content as the nutritive value is much higher. Collectively proximate analysis showed that leaves of *Chrysophyllumalbidum* have the potential to be a food supplement, energy drink and a nutraceutical. It has been recognized that the total phenol contents (TPC) of plant extract are directly related to the antioxidant activities due to their redox properties.

The minimum and maximum capacity of scavenging free radicals of the sample ranged between % and 56% and this inhibition capacity was greater than ascorbic acid standard (20%-94.86%). The concentration of extract providing 50% of radicals scavenging activity (IC_{50}) was calculated from the graph of DPPH inhibition percentage against the extract concentration. Thus, the IC_{50} of the sample was 1.32mg/ml and ascorbic acid was 2.4mg/ml. The lower the IC_{50}value is, the higher the scavenging potential. The differences in antioxidant activity might be associated with the levels of phenolic compounds since the influence of an extract phenolic composition in the antioxidant capacity is a well-known fact (Lien *et al.*, 1999).

Antioxidants are compounds which can scavenge the free radicals produced due to various biochemical processes in the human body and prevent the damage induced by them. They can effectively reduce oxidative damage of human body from reactive oxygen species (ROS) by neutralizing the free radicals before they can attack the cells and prevent damage to lipids, proteins and enzymes, carbohydrates and DNA. The effect of antioxidants on DPPH radical was thought to be due to their hydrogen donating ability to the free radicals and reducing it to nonreactive species (Boakye *et al.*, 2015).Flavonoids and phenolic compounds widely distributed in plants which have been reported to exert multiple biological effect, including free radical scavenging abilities, anti-inflammatory, anti-carcinogenic etc (Adegbesan, 2019).The presence of phenols and flavonoids were also revealed in the present investigation.

The search for identifying natural antioxidants in plants is the most happening area in research as most natural antioxidants are multifunctional, safe and with lesser side effects.

CONCLUSION

The present study reveals the presence of important phytochemicals, moisture, carbohydrates, crude proteins and crude fat in the plant leaf, bark and root. The sample showed antioxidant property and this reaffirms the medicinal and nutritive potential of *C, albidum*. Because of the presence of above said properties and nutritional factors *C. albidum*, bark and root can be considered as a potential candidate for fodder additive.

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