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# PHYTOCHEMICAL SCREENING AND PROXIMATE ANALYSES OF SOME MEDICINAL PLANTS USED IN IRUN AKOKO, AKOKO NORTH WEST LOCAL GOVERNMENT AREA ONDO STATE, NIGERIA

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**ABSTRACT:** *The study was designed to focus on the potential of seven selected medicinal plants vis Azadiracta indica (A.Juss), Saraca indica (Linn.), Cymbopogon citratus (DC. Stapf,), Morinda lucida, (Benth.), Moringa oleifera (Lam.), Acacia senegalens (Houtt.), and Gossypium arboretum (Jacq.). The plants are relatively available, effective, disease resistance, less toxic and found traditionally medicinal relevance in the study area.This work was designed to identify secondary metabolites present in the leaves extracts of Azadiracta indica (A.Juss). Saraca indica (Linn.), Cymbopogon citratus (DC. Stapf,), Morinda lucida, (Benth.), Moringa oleifera (Lam.), Acacia senegalens (Houtt.), and Gossypium arboretum (Jacq.) to validate their traditional importancePhytochemical screening and proximate analysis was carried out using standard qualitative and quantitative tests respectively. The screening assessed and determined the proximate composition of Azadiracta indica; Saraca indica; Cymbopogon citratus; Morinda lucida; Moringa oleifera; Acacia senegalens; and Gossypium arboretum. Statistical analysis was performed by one-way analysis of variance (ANOVA) while Duncan's New Multiple range test were applied at 0.05 level of significance (p < 0.05). Phytochemical screening of the plants revealed the presence of alkaloids, saponins, tannins, phenols and flavonoids. Nutritional analysis revealed that all the plants were rich in crude protein, carbohydrate, fat, ash, moisture and dietary fiber. Morinda lucida has the highest moisture contents of 13.42± 0.05 % while Saraca indica has the least moisture contents of 9.19± 0.52 %. Acacia senegalens has the highest fat contents of 6.17±0.70 % while Azardiracta indica has the least contents of 2.84 ± 0.19 %. Similarly, Gossypium arboretum has the highest ash content of 13.46± 0.08 while Saraca indica is having least ash content of 6.60±0.03 %. Moringa oleifera has the highest proteins contents of 7.81±0.08 % while Cymbopogon citratus has least protein content of 3.64± 0.05 %. Gossypium arbereum has the highest number of fibers 11.28± 0.11 % while Saraca indica is having least fiber contents of 7.35± 0.14 %. Also, Saraca indica has the highest carbohydrates contents of 67.69 ± 0.11 while Moringa oleifera is having the least of carbohydrates content of 52.97±0.23 % respectively. Proximate composition in the plants supported various body functions such as body development, maintenance of fluid balance, formation of hormones, enzymes, repair of worn out tissues, sustaining strong immune function among others. Therefore, the results of this study validated the traditional relevance of the plants.*

**KEY WORDS**: aqueous solvents, medicinal plant, phytochemical, proximate, traditional relevance

## INTRODUCTION

The use of various parts of plants in the prevention and treatment of many ailments is now experiencing positive awareness especially amongst the rural dwellers because of their availability, cheaper prices, effectiveness and resistance to disease caused organisms (Rajendra et al., 2019., Arowosegbe *et. al*.,

2020). Since the ancient's days, early man observed and believed that plants have healing powers. Many plants synthesize substances useful in the maintenance of health in man and animals. These are called bioactive substances called secondary metabolites that are include aromatic substances, most of which are phenols or oxygen substituted derivativeness such as tannins (Chellappandian *et al.* (2012). The World Health Organization (WHO 2001) estimated that up to 80% of the world's population rely on plants for their primary health care, while in Nigeria, a WHO survey estimated that up to 75% of the population personally used plants in various forms or patronized traditional medical practitioners in managing their health challenges. Medicinal plants play a significant role in the provision of nutritious food to people (Thangaraj et al., 2014; Latif *et. al*., 2003). Interestingly, medicinal plant species has its own phytochemicals and nutritional composition that makes it effective and pharmacologically important for the various functions they perform but unfortunately a few number of these plants have been studied and known to have therapeutic value (Adamu, 2008). Bioactive ingredients in medicinal plants are biochemical in nature and they varied from carbohydrates, fats, proteins, fibers and moisture contents, thus they are essential for the physiological functions of human body. Their mode of administration varies from the form of extract, decoction and concoction to cure various diseases (Latif et al., 2004). As at present a substantial number of drugs are developed from plants which are active against a number of ailments and disease conditions such as hypertension, pains, fever, cancer, diabetes, arthritis, gastrointestinal diseases and so on Harvey, (2008); Patel et al., (2010). Also, Patwardhan *et. al*., (2004) reported that in the developed countries 25% of the synthetic drugs are based on plants and their derivatives because of the chemical compound found in plants and their subsequent modification.

However, it has been observed that the compound in many plants responsible for their therapeutic actions are yet to be well examined to justify and validate their traditional use in the study area. Therefore the validation of traditional importance of some selected plants such as *Azadiracta indica* (A.Juss). *Saraca indica* (Linn.), *Cymbopogon citratus* (DC. Stapf,), *Morinda lucida,* (Benth.), *Moringa oleifera* (Lam.), *Acacia senegalens* (Houtt.) *and Gossypium arboretum* (Jacq.) is imperatives.

Azadiracthta indica: is locally known as Neem tree. It is a tree in the mahogany family of *Meliaceae*. It has one or two species in the genus of *Azadirachta*. It is native to India, Bangladesh, Thailand, Nepal and Pakistan. It is growing well in tropical and sub-tropical regions. The neem oil is isolated from its fruits and seeds (Akter et al., 2013., Harbone, 1998). Neem is the most important medicinal plant that has been declared worldwide as the "Tree of the 21st century. Therapeutically, it is used to prepare formulated medicine for the treatment of a variety of human ailment such as cleaning of teeth with neem twigs. Drinking of its juice is considered as a good tonic to increase appetite and cure fever or to kill intestinal worms, its crude extracts from bark and leaves have been used in folk medicine to control diseases such as leprosy, intestinal problems, helminthiasis and respiratory system Yerima *et al.,* (2012). Besides these uses, there are several other reports on the biological and pharmacological actions such as antiviral, antibacterial, antifungal, anti-inflammatory, antipyretic, antiseptic etc.

*Saraca asoka* (family Caesalpiniaceae) also known as *Saraca asoka* is one of the most ancient sacred plants widely distributed throughout the Indian subcontinent Bhalerao *et. al.,* 2014. Different parts of the plant exhibit a number of pharmacological effects like antihyperglycemic, antipyretic, antibacterial, anthelmintic, activity, and so forth (Kumar *et al*., 2012; Sasmal *et. al*., 2012; Sarojini *et. al.,* 2011; Suja *et. al*., 2012 ). A traditional drug Asoka Aristha used for the treatment of menorrhagia, helps in conception, ovarian-stimulant and strengthened uterine muscles in female reproductive problems is originated from *Saraca indica*. Secondary metabolites like flavonoids, terpenoid, lignin, phenolic compounds, tannins, and so forth are reported from Saraca indica stem bark extracts and found responsible for their therapeutic action Saha, et al 2013; Cibin et al., 2012.

***Cymbopogon citratus***, commonly known as **West Indian lemon grass** or simply **lemon grass.** It is a tropical plant native to Island Southeast Asia and introduced to many tropical regions *Cymbopogon citratus* is often sold in stem form Gagan *et. al.,* (2011). Its fragrant leaves are traditionally used in cooking, particularly for *lechon* and roasted chicken (Carbajal *et al*., (1989). The dried leaves can also be brewed into a tea, either alone or as a flavoring in other teas, imparting a flavor reminiscent of lemon juice but with a mild sweetness without significant sourness or tartness. The plant is also used as an antibacterial, antidiarrheal and antioxidant. Similarly, *Cymbopogon citratus* contains various phytoconstituents such as flavonoids and phenolic compounds, terpenoids and essential oils, which may be responsible for the different biological activities Melo *et al*., 2001; Onawunmia *et al*., 1984; Blanco et al 2009. Also, the Methanol, MeOH/water extracts, infusion and decoction of *Cymbopogon citratus* were shown to have free radical scavenging effects by measuring the bleaching of the 1, 1-diphenyl-2-picryl-hydrazyl (DPPH) radical, scavenging of the superoxide anion and inhibition of the enzyme xanthine oxidase and lipid peroxidation in human erythrocytes Gagan *et. al.*, (2011) Cheel *et. al.*, (2005).

*Morinda lucida*

***Morinda*** is a genus of flowering plants in family, Rubiaceae. The generic name is derived from the Latin words *morus* "mulberry". All *Morinda* species bear aggregate or multiple fruits that can be fleshy (like *Morinda citrifolia*) or dry (Talukdar *et al*., 2010). Most species of this genus originate in the area of Borneo, New Guinea, Northern Australia and New Caledonia (Wallnöfer, 2011). Morinda lucida has antimalarial, antibacterial and antioxidant properties. Morinda lucida is a nutrient factory and is readily available throughout the year in southwestern Nigeria. It is rich source of two powerful antioxidants, vitamins A and E which could be effective in combating degenerative diseases like atherosclerosis; vitamin K, different secondary metabolites responsible for the ethnomedicinal properties of the plant,- alkaloids, tannins, saponins, flavonoids, phenols. The plant is an excellent source of phytochemical constituent and nutritive components (Adeleye *et al.*, 2018).

***Gossypium arboreum : Gossypium arboreum***, commonly called **tree cotton**, is a species of cotton native to India, Pakistan and other tropical and subtropical regions of the Old World. This species of cotton was also introduced into East Africa and was grown by the Meroe civilization in Nubia. The shrub was included in Linnaeus's *Species Plantarum* published in 1753. The holotype was also supplied by him, which is now in the Linnean Herbarium in the Swedish Museum of Natural History. It is a sister species of *Gossypium herbaceum*. *Gossypium arboreum* var. *neglecta*, locally known as "Phuti karpas", is the variant used to make Muslin in East India, now Bangladesh. It is widely used in African traditional medicine. The root is considered am emmenagogue and to cause uterine contractions and can be taken as an abortifacient. The juice of the root is used in the treatment of fever Wendel *et al.,* (2010.

*Moringa oleifera:* ***Moringa oleifera*** is a fast-growing, drought-resistant tree of the family Moringaceae, native to tropical and subtropical regions of South Asia. Common name is moringa, (Yoshida and Hatano, 2000; Kumar 2010). It is widely cultivated for its young seed pods and leaves used as vegetables and for traditional herbal medicine. It is also used for water purification. *M. oleifera* is considered to be an aggressive invasive species. *M. oleifera* is a fast-growing, deciduous tree that can reach a height of 10–12 m (32–40 ft) and trunk diameter of 45 cm (1.5 ft), (Yoshida and Hatano, 2000). The plant various parts such as leaves, roots, stem, bark, fruits, flowers acts as cardiac and circulatory stimulants, possess anti-inflammatory, antihypertensive and antioxidant Ghazanfar and Al-Al-Sabahi, 1993). The young leaves of M. peregrina are used traditionally in folk medicine as antioxidant and wound healing in Arab countries. The bark juice is also used as disinfectant (Marwah et al., 2007) and

also to treat fever, headache, constipation, back and muscle pains, slimness, burns and labor pain (Tahany et al., 2010). The leaves are used for wound healing (Nawash and AlHorani, 2011).
*Acacia senegalens* (Houtt.): The characterization of the active compound that plays a role for treating human diseases (infection, cancer, etc.) represents a key step in phytochemical research of new compounds. *Acacia senegalens* is used in managing Respiratory infections, Flue, sinusitis, Toothaches, Different parts of the plant species are used dry or in liquid form after maceration or decoction for general treatment of bacterial, viral, parasitic infections or used to treat symptoms in gastroenterology, dermatology, hematology, rheumatology and inflammation Thoen and Thiam 19 Diallo et al.,2007; Maiga et al. 2005; Nacoulma and Millogo-Rasolodimby (1985); Tapsoba and Deschamps (2006).

## MATERIALS AND METHOD

The study was carried out in Irun Akoko, Akoko North West Local Government Area Ondo State. The population of the study area was 180,621. Irun Akoko found between 7° 35'17'' N latitude and 5° 40' 11" E longitude. The people of Irun Akoko are sub-ethnic group of the Yoruba involving majorly in subsistence agricultural practices. The region is humid having mild summer with average annual rainfall exceeds 1000 mm and mean annual temperature of about 18°C (Adnan *et. al.,* 2006).

### Collection of Plant Samples

### Processing and sample preparation

The leaves of plants of *Azadiracta indica* (A.Juss). *Saraca indica* (Linn.), *Cymbopogon citratus* (DC. Stapf,), *Morinda lucida,* (Benth.), *Moringa oleifera* (Lam.), *Acacia senegalens* (Houtt.) *and Gossypium arboretum* (Jacq.) were collected from various farms located in the study area. The traditional importance of the plants were provided by the inhabitants of the study area and documented. The fresh and matured samples of the plants were scientifically authenticated at the herbarium units of the Plant Science and Biotechnology Department laboratory, Ekiti State University while the vouchers specimens were prepared and deposited at the Herbarium. The leaves of the plants samples collected were thoroughly washed with distilled water and shade-dried at room temperature for 3-4 weeks. The dried leaves were ground, blended to powdered form through the use of pestle and mortal and stored in airtight containers in preparation for the analyses of phytochemical and proximate constituents.

### Extraction of plants Materials

A 100 g of the powdered plant material was carefully weighed and loaded into a soxhlet extractor. The powdered plant material was extracted separately with redistilled ethanolic solvent using soxhlet extraction and cold maceration method (Harbone, 1984). The extract was then concentrated in vacuo- using rotary evaporator at about $40^0$C and finally was subsequently subjected to air drying to give dried extracts for further analysis.

### Phytochemical screening

Phytochemical screening procedures carried out were adopted from the previous work on plant analysis Odebiyi and Sofowora, 1999., Trease and Evans, 2002; A.O.A.C. (1980); Kumar 2010 This analysis provides information on the biologically activity and non- nutritive compounds that contribute to the flavor,

colour and other characteristics of plant parts. Examples of these are, Tannins, Glycosides, Phenolics, Steroids, Saponins by froth test; Alkaloids by legal's test, and Flavonoids by Shinoda test

**Proximate analysis**

The proximate analysis (carbohydrates, fats, proteins, moisture and ash) of the plant samples were determined by using AOAC methods. Carbohydrate was determined using [100 - (Protein +Fats +moisture +ash)]. The nitrogen value, which is the precursor for protein of a substance, was determined by micro Kjeldahl method. The nitrogen value was converted to protein by multiplying to a factor of 6.25. The moisture and ash were determined using weight difference method while determination of crude lipid content of the samples was done using Soxhlet type of the direct solvent extraction method. The solvent used were aqueous and methanol (boiling range 40 - 60°C). All the proximate values were reported in percentage (AOAC, 2000; Okwu *et al*., 2004; Hussain *et al*., 2009).

**Statistical analysis**

Data from the procedure were summarized using two-way ANOVA to analyze the results.

**Ethical consideration:**

This article followed all ethical standards for research without direct contact with human or animal subjects

**RESULTS AND DISCUSION**

Table 1 shows that the seven studied plants belongs to six families. The plants were found used traditionally as antibacterial, antifungal, anti-inflammatory, antioxidant, antidiebetics, anticancer etc. The part used by all the plants were leaves and the collection of the leaves of the plants is effective and preferred to when other parts like stem bark and roots were used. Harvesting of leaves could not easily hindered the existence of the plants since leaves can regenerate as soon as possible when harvested.

**Table 1. List of selected plants used traditionally to manage various diseases in the study area.**

| S/N | BOTANICAL NAME/AUTHORITY | FAMILY NAME | LOCAL NAME/COMMON NAME | PART USED | HABIT |
|---|---|---|---|---|---|
| 1 | *Azadiracta indica* (A.Juss). | Meliaceae | Ewe Dongoyaro/Neem leaves | Leaves | Tree |
| 2 | *Saraca asoka* (Linn.) | Fabaceae | Igi egungun/ Masquerade tree | Leaves | Tree |
| 3 | *Cymbopogon citratus* (Stapf,) | Poaceae | Tealeaves/ Lemon tea | Leaves | Herb |
| 4 | *Morinda lucida* (Benth.), | Rubiaceae | Morinda | Leaves | Shrub |
| 5 | *Moringa oleifera* (Lam.) | Moringaceae | Ewe igbale/ Moringa | Leaves | Shrub |
| 6 | *Acacia senegalensis* (Houtt.) | Fabaceae | Ewe kasia/ Cassia leaves | Leaves | Tree |
| 7 | *Gossypium arboretum* (L) | Malvaceae | Tree cotton leaves/ Ewe Owu | Leaves | Tree |

The Phytochemical screening of the aqueous extract of the seven tested plants revealed the presence of various phytochemical compound (Table 2). This results showed that the leaves of the plants were rich in alkaloids, flavonoids, tannins and saponins.

**Table 2: Phytochemical screening of the aqueous extract of the plants species**

| Name of plants | Alkaloids | Saponins | Flavonoids | Phenols | Tannins | Glycosides |
|---|---|---|---|---|---|---|
| *Azadirahta indica* | ++ | + | ++ | + | + | + |
| *Saraca indica* | + | + | ++ | + | + | + |
| *Cymbopogon citratus* | + | ++ | ++ | + | + | + |
| *Morinda lucida* | ++ | + | + | + | + | + |
| *Moringa oleifera* | ++ | + | ++ | + | + | + |
| *Acacia senegalens* | + | + | + | + | + | + |
| *Gossypium arboereum* | ++ | + | + | + | ++ | + |

Keys: + Sparingly present
++ Abundantly present

Nutritional composition

The plant samples contained a relatively percentage of carbohydrate, Fat, Ash, Protein, Crude fiber and Moisture contents at varying levels (Table 2). The results shows that there are no significance differences in the moisture contents present in *Morinda lucida Moringa oleifera*, Cymbopogon *citratus*, *Acacia senegalense* and *Gossypium arbrecum* respectively. *Morinda lucida* has the highest moisture contents of $13.12\pm0.049^{a}$, this is followed by *Moringa oleifera* with moisture content $13.12\pm0.049^{a}$ while *Saraca indica* and *Cymbopogon citratus* are of least moisture content of $9.19\pm0.516^{f}$ and $10.15\pm0.113^{c}$ respectively. However, there are significant differences in the moisture contents found in *Azadirachta indica* ($11.32\pm0.126^{c}$) and *Saraca indica* ($9.19 \pm 0.516^{c}$). Also it was equally observed that *Acacia senegalens* has the highest fat content of $6.17\pm 0.70^{c}$, followed by *Moringa oleifera* ($6.10\pm 0.28^{a}$), *Morinda lucida* ($5.11\pm0.14^{b}$), *Gossypium arbrecum* ($4.44\pm0.12^{c}$), *Cymbopogan citratus (3.86*$\pm0.49^{d}$), *Saraca indica (3.37*$\pm0.12^{c}$) *and Azardiracta indica* ($2.84\pm0.19^{f}$) respectively. Also the ash contents of *Gossypium arboreum* was higher with $13.46\pm0.08^{a}$ while *Saraca indica* have the least ash contents of $6.60\pm0.03^{g}$. However, there are no significance difference in *Morinda lucida* and *Acacia senegalis* with fat contents of $9.07\pm0.07^{c}$ and $7.58\pm0.21^{c}$ respectively. The protein composition of the study plants, shows that *Moringa oleifera* has a significance difference with the highest protein contents of $7.81\pm0.08^{a}$ over *Saraca indica* with the protein contents of $5.81\pm0.06^{b}$, while *Cymbopogan citratus* and *Azardiracta indica* are made up of the least protein contents of

3.64±0.05[f] and 4.81±0.06[c] respectively. There are significant differences between *Moringa oleifera* and *Saraca indica*. Also there are significant differences between *Cymbopogan citratus* 3.64±0.05[f] and *Azardiracta indica* 4.81±0.06[c], There are no significant differences between *Acacia senegalensis, Gossypium arboreum* and *Azardiracta indica* with protein content 5.27±0.02, 4.87±0.07 and 4.81±0.06 respectively. The crude fibers contents in all the plant samples revealed that *Gossypium arboreum* has the highest crude fiber contents of 11.28±0.11[a], followed by *Moringa oleifera* with crude fiber contents of 10.23±0.16[b], while *Saraca indica* and *Cymbopogan citratus* are made up of the least crude fibers contents of 7.35±0.14[c] and 8.32±0.03[d] respectively. It was also observed from the table that the carbohydrate contents in *Cymbopogan citratus* shows higher carbohydrate contents of 66.87±0.16[f] and it is significantly different from *Moringa oleifera* with the least carbohydrate contents of 52.97±0.23[d].

**Table 3: Proximate composition of the selected plants in the study area**

| Name of the plants | Moisture content (%) | Fat (%) | Ash (%) | Protein (%) | Crude fiber (%) | Carbohydrate (%) |
|---|---|---|---|---|---|---|
| *Azadirachta indica* | 11.32± 0.126[d] | 2.84± 0.19[f] | 8.26± 0.06[d] | 4.81± 0.06[e] | 9.10± 0.03[c] | 63.69 ± 0.64[bc] |
| *Saraca indica* | 9.19± 0.516[f] | 3.37± 0.12[c] | 6.60± 0.03[g] | 5.81± 0.06[b] | 7.35± 0.14[c] | 67.69 ± 0.11[c] |
| *Cymbopogon citratus* | 10.15± 0.113[c] | 3.86± 0.49[d] | 7.17± 0.84[f] | 3.64± 0.05[f] | 8.32± 0.03[d] | 66.87 ± 0.16[f] |
| *Morinda lucida* | 13.42± 0.049[a] | 5.11± 0.14[b] | 9.07± 0.07[c] | 5.12± 0.04[d] | 10.09± 0.42[b] | 60.21 ± 4.24[b] |
| *Moringa oleifera* | 13.12± 0.049[a] | 6.100± 0.28[a] | 9.78± 0.02[b] | 7.81± 00.8[a] | 10.23± 0.16[b] | 52.97 ± 0.23[d] |
| *Acacia senegalis* | 12.62± 0.049[c] | 6.17± 0.70[c] | 7.58± 021[c] | 5.27± 0.02[c] | 8.37± 0.12[a] | 60.01 ± 0.28[c] |
| *Gossypium arbereum* | 12.72± 0.049[c] | 4.44± 0.12[c] | 13.46± 0.08[a] | 4.87± 0.07[c] | 11.28± 0.11[a] | 53.25 ± 0.26[d] |

Means in the same column followed by the same letter(s) are not significantly different at $p \geq 0.05$

## DISCUSSION

### Extraction of the active ingredients

The plants were found used traditionally for their various medicinal values, therefore they could be a good source of medicine to protecting the body against outbreak of degenerating diseases (Iqbal and Hamayun, 2002). Water is an organic polar solvents, having higher polarity that is capable to extracts the bioactive component of the plants viz: *Azadiracta indica* (A.Juss), *Saraca indica* (Linn.), *Cymbopogon citratus* (DC. Stapf,), *Morinda lucida,* (Benth.), *Moringa oleifera* (Lam.), *Acacia senegalens* (Houtt.) *and Gossypium arboretum* (Jacq.) Also, Water is electron donors and could react with free radicals to convert them to more stable products and terminated the radical chain reaction that usually cause degenerative diseases. The phytochemical screening of the plant extracts revealed the presence of various bioactive compounds in the medicinal plants and they were found contributed to the medicinal value as well as physiological activity of the users (Shirolkar *et al.,* (2013); Hhrma *et al.,* (2007); Sofowora, 1993). They were known to show

medicinal activity as well as exhibiting physiological activity (Sofowora, 1993).This therefore confirmed that the plants contain therapeutic substances which could be responsible to alleviates or manage various diseased conditions. Saponins from plants have long been employed for their detergent properties. It is used as mild detergents and in intracellular histochemistry staining to allow antibody access to intracellular proteins. In medicine, it is used in hypercholesterolaemia, hyperglycaemia, antioxidant, anti-cancer, anti-inflammatory and weight loss etc, (Ngbede *et al.,* 2008). Also, Seigler (1998) reported that saponins have anticarcinogens' properties, immune modulatory activity and cholesterol lowering activity. it is also been reported to have anti-fungal properties (Sodipo *et al.,*1991). Some saponins glycosides are cardiotonics while others are contraceptives and precursors for other sex hormones (Trease and Evans 2002). Tannins sacs are known to be common in Caesalpinoideae and known to exhibit antiviral, antibacterial and anti-tumor activities. It was also reported that certain tannins are able to inhibit HIV replication selectively and is also used as diuretic. Plant tannins are also source of commercial tannic acids and tanning agents (Trease and Evans 2002).Flavonoids and phenols have wide range of pharmacological effects including antioxidant, anti-inflammation, antiplatelet, anti-allergic, cytoxicity and reduce risk of heart disease (Mohammad and Etham, 2013).

**Proximate composition of the plants**

The level of nutrients present in the plant samples determine their functions in the body and this varies from the provision of energy, to the building up of blood, cells, tissues and binding up and repairing of worn out tissues. The mean value of the carbohydrates of the leaves of all the plants are relatively high, though not as high as the value of carbohydrate (80%) in *B. falcatum* (Akter *et al.,* (2013) Latif *et.al.,* 2003) but it is still preferred when compared with plant like *Croton tiglium* with the low yield of carbohydrates of 15.51% (Shah *et al*., 2009). Therefore the plants could be used as sources of energy. The crude protein contents of all the studied plants are higher when compared to 1.98% as reported for *Securinea virosa* leaves and *G. hirsutum* (2.70±0.01) and *M. charantia* (2.46±0.03) respectively (Danlami *et al.,* 2012). However, crude protein is associates with amino acids. It is expected to be up to minimum of 12% of calorific value in the plants species. Protein is responsible for the building up of blood, antibodies and replacement of the worn out tissues (Ali, 2010).

Also, the moisture contents of the plants is very low when compared with some leafy vegetables consumed in Nigeria such as *Colosia argenta* (80%), *Amaranthus cruentus* (86%) and *Vernonia amygdalina* (37.67%) having high moisture contents Igile *et al.* 2013 and Mensal *et al.* 2008. This indicates that the plants have a long shelf life and are quite succulent. However, the moisture contents in all the plants have higher values than what was reported for *Gnetum africanum* (9.18%) and *Telfaria occidentalis* (8.64%) (Dike 2010; Bose 2007). The level of moisture content values in plants is responsible for the prevention of the plants from spoilage by microorganisms and for the optimum function of the cells of the body Hameed and Dastagir (2009). *Gossypium arbereum* has the highest fiber contents among all the plants. Nutritionally this is important as been reported by Bouba *et al.,*(2012), Kelsay, 1981, Le Veille and Sanberlich, 1966, Iheanacho and Ubebani (2009) because fiber aids absorption and digestion of trace element in the gut, it also responsible for the reduction of cholesterol in the body. Also, the crude fiber contents in the plants were within the range of the reported values (8.50-20.90%) for some Nigerian vegetables (Misurcova *et al.,* 2010; Ali, 2010). The crude fat contents of the plants were lower when compared with 15% in *Costus afer* and 11.00% in *Cedrela odorata* as reported by (Asekun *et al.* 2013; Tusharkumar, (2011)) but higher than the values obtained in spinach leaves, *Cnidoscolus acoitifolius* leaves and *Amaranthus hybridus* leaves respectively (Nwaogu *et al.* 2000). However the crude fat obtained from some of the present study plants are relatively close to the values of *Gossypium hissuhum* 6.57± 0.04 and *Momordica charantia* 5.83± 0.01

respectively. The fat contents of the studied plants were low and it can be recommended as part of weight reducing diets. The low fat food reduces level of cholesterol and thereby reduces obesity and every degenerated disease related to fat intake.

The ash contents values of the leaves of the plants are lower compared to the ash contents reported for *G. hirsum* (18.72%) and *M .charantia* (14.71%) respectively by Onwuka (2005). However the values are compared favorably with values of *Urera trinervis* (5.54%) and *Hippocratea myriantha* 6.14% respectively (Andzouana and Mombouli, 2012). The presence of ash contents is an indication of the level of minerals and organic matter present in the plant thereby justify the traditional importance of the plants.

**CONCLUSION**

This work validated the traditional importance of the plants as they are claimed used in managing various diseases. The phytochemical screening revealed the presence of active pharmacological compounds. The plants could be used to provide various vital body function such as body development, maintenance of fluid balance, formation of hormones, enzymes and sustaining strong immune function among others. Nutritionally, they compared favorably with most popularly consumed vegetables based on their moisture content, ash content, crude lipid, crude fibre, crude protein and carbohydrate. The result suggested that the plant leaves if consumed in sufficient amount could contribute greatly towards meeting human nutritional requirement for normal growth and adequate protection against diseases arising from malnutrition However, further research is required to isolate, elucidate the active principles and advanced molecular and pharmaceutical linkage of the plants. Also, the mechanism of their antioxidant activity could be investigated for their potential applications in therapeutics.

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**Competing interests**
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**Authors' contributions**
M.K Olanipekun designed the study, carried out all laboratory experiments and wrote the manuscript. K, Akirun carry out the laboratory experiment while J.A Amoo collected the plant samples. All authors read and approved the final manuscript.

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