



Review Article

Phytochemical Compositions in Some Nigerian Medicinal Plants and Their Pharmacological Properties: A Review

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Abstract: Nigeria is naturally blessed with both savannah and tropical rainforests vegetation and these offer a wide distribution of plants believed to possess secondary metabolites which are responsible for treating or curing various diseases. Several researches have been carried out in order to explore and identify the chemical compositions responsible for various pharmacological activities in Nigerian medicinal plants. This paper discussed the meaning and historical development of medicinal plants. A brief account of phytochemicals (alkaloids and flavonoids) were also given. The plants presented in this paper confirmed the pharmacological activities of these plants and includes; anticonvulsant, antioxidant, antibacterial, anxiolytic, antiinflammatory, antiulcer, anticancer, antiparasitic, antitrypanosomal, antithyroid, antitumor, antileishmanial, antidiarrhoeal, antidiabetic, antituberculosis, analgesic as well as others.

Keywords: Alkaloids, Flavonoids, Medicinal Plants, Phytochemicals, Pharmacological Properties

1. Introduction

Plants that possess therapeutic properties or exert beneficial pharmacological effects on the human body are generally designated as medicinal plants [1]. A medicinal plant is any plant which in one or more of its organs contains active ingredient which is used for therapeutic purposes or contain foundation compounds that can be used for synthesis of useful drugs [2]. Doughari [3] explained that, medicinal plant is a plant which, in one or more of its organs, contains substances that can be used for therapeutic purposes or which are precursors for chemo-pharmaceutical semi synthesis. Medicinal plants naturally synthesize and accumulate some secondary metabolites, like alkaloids, sterols, terpenes, flavonoids, saponins, glycosides, cyanogenics, tannins, resins, lactones, volatile oils as well as others [1]. The part of plants in used include; leaves, roots, rhizomes, stems, barks, flowers, fruits, grains, or seeds and these contains chemical components which are used for control and treatment of a

diseases. Araujo *et al.*, [4] stated that, medicinal plants have been used as a means of curing or preventing diseases known as "phytotherapy" in all regions of the world, with regional variations due to the influence of cultural characteristics of the population, as well as its flora, soil and climate. According to Motaleb *et al.*, [1] researchers have found that people in different parts of the world tend to use the same or similar plants for treating the same illness. WHO estimated that 80% of the people globally rely on herbal medicines [1, 5-6], partially for their primary health care [7-11]. Medicinal plants have assessed their therapeutic efficacy and toxicology, or safety of use evaluated, among other properties, are scientifically approved to be used by people in their basic needs, due to their ease of access, low cost and compatibility with cultural traditions [12]. This paper aimed to provide detail information regarding the phytochemical compositions and pharmacological potentials of some Nigerian medicinal plants.

2. Historical Development of Medicinal Plants

The therapeutic use of plants goes back to the Sumerian and the Akkadian civilization in about the 3rd millennium B. C [3]. Papyrus Ebers is an old document written in 1500 BC, which described the use of medicinal plants, animal and human anatomy by the ancient Egyptians as reported by Djordjevic [13]. Hippocrates (460-370 BC) a Greek physician is considered as a father of medicine, described human anatomy and physiology. Theophrastus (371-286 BC) together with his students founded the first botanical garden in Athens and also described more than 500 most important medicinal plants. Another Greek physician Dioscorides (78 AD), [14] in his book "De Materia Medica" described thousands of medicinal plants and their properties. Ibn Attabari (770-850), Ibn Sina (980-1037) in his book "Canon of Medicines" and Ibn Albitar (1148-1197) all contributed for the medicinal plants exploration. Caventou, Pelletier, and Quinine were the first chemists to have isolated alkaloids from medicinal plants called "*Papaver somniferum*" [15].

3. Phytochemicals

Phytochemicals are chemical compounds formed during the plants [16], normal metabolic processes. These chemicals are referred to as secondary metabolites which comprises of several classes and these includes; alkaloids, flavonoids, phenols, tannins, [17-18], coumarins, glycosides, gums, polysaccharides, terpenes, terpenoids, [19-20]. Plants may contain other substances apart from the aforementioned chemicals. In this paper, a brief account of alkaloids and flavonoids will be given.

3.1. Alkaloids

Alkaloids are group of naturally occurring chemical compounds which mostly contain basic nitrogen atoms [15]. In other word, alkaloids are nitrogenous secondary metabolites heterocyclic derivatives of amino acids or by the transamination process which confers basic characters [21]. The group includes some related compounds with neutral and even weakly acidic properties. In addition to carbon, hydrogen and nitrogen, the group may contain some other elements such as oxygen, sulphur and more rarely other elements like chlorine, bromine and phosphorus [15]. Alkaloids are classified based on biosynthetic pathways [22]. Lu *et al.*, [22] observed that, alkaloids have a wide distribution in the plant kingdom and mainly exist in higher plants, such as those belonging to the family *Ranunculaceae*, *Leguminosae*, *Papaveraceae*, *Menispermaceae* and *Loganiaceae*. Approximately 60% of the drugs from plants are alkaloids [23]. Lu *et al.*, [22] asserted that, alkaloids exhibit significance biological activities, examples are the relieving action of ephedrine for asthma, the analgesic action of morphine, the anticancer effects of vinblastine [22, 24]. Quinine has been used in the treatment of malaria atropine serves as a

vasodilator, berberine is used in the treatment of diarrhea, diabetes and others [22]. Other important alkaloids include evodiamine, piperine, sanguinarine, matrine, tetrandrine, caffeine, codeine, tubocurarine, sanguinafine, cocaine, ajmaline, scopolamine, atropine, hyoscamine [25], nicotine, ergotamine.

3.2. Flavonoids

Flavonoids belong to a group of natural substances with variable phenolic structures and are found in fruits, vegetables, grains, bark, roots, stems, flowers, tea and wine [26-27]. Several studies shown that more than 4000 varieties of flavonoids were identified, many of which are responsible for their attractive colours of flowers, fruits and leaves [26-27]. According to Marais *et al.*, [28] the study of flavonoid chemistry has emerged like that of natural products from the search of new compounds with useful physiological properties. This group of natural products are categorized into classes depending on the position of the linkage of the aromatic ring to the benzopyrano (chromano) moiety as mentioned by Marais *et al.*, [28] and these includes; flavones, flavonones, flavanols [29] isoflavonones isoflavones, and anthocyanidins, [27]. A large number of studies showed that, flavonoids have a wide range of biological activities such as free radical scavenging, antioxidant, anti -inflammation, anti-cancer, bactericidal, regulating immunity, antiviral, [30-31], antimutation, antitumor, Protecting liver, and anti-allergic and antidiabetes [32]. A number of reports have been published which demonstrate that flavonoids can modulate arachidonic acid metabolism via the inhibition of cyclo-oxygenase and lipoxygenase activity [33].

4. Pharmacological Activities of Nigerian Medicinal Plants

Nigeria is naturally blessed with both savannah and tropical rainforests vegetation and these offer a wide spectrum of unique medicinal plants [34]. In Nigeria, the indigenous people are exploring and exploiting a variety of herbs for effective curing of various diseases. Several studies on ethnobotanical, ethnopharmacological and phytochemical were carried out from Nigerian medicinal plants. Medicinal plants have been in use all over the world for the treatments of various diseases including; cancer, heart disease, infections, inflammation and other diseases [25].

Leptadenia hastata has been used as vegetables in Nigeria and other countries due to its nutritive and therapeutic purposes. Abubakar *et al.*, [35] reported the presence of alkaloids, flavonoids, saponins, tannins, glycosides and other phytoconstituents. This is in tandem with the report of [36-38] whom also detected the presence of alkaloids, flavonoids, glycosides, saponins and tannins. The pharmacological activities reported are; antidiabetic [38-39] antibacterial [35-36] and antioxidant effects.

Abubakar *et al.*, [40] reported that, the leaves of *Ficus sycomorus* have antidiabetic, antioxidant, antitumor, and

antibacterial activity. Also the aqueous extract of stem bark exhibits sedative, anticonvulsant and muscular activities due to the presence of alkaloids, flavonoids and other phytoconstituents. In another studies, Abubakar *et al.*, [41] stated that, *F. sycomorus* root bark extract contains alkaloids, flavonoids, tannins, terpenoids, saponins, carbohydrates, steroids, cardiac glycosides. Also found the root bark extract of *F. sycomorus* possesses antimicrobial activities.

Alkaloids, flavonoids, carbohydrates, tannins, terpenes and saponins were found to be present in the leaves of *Globimetula oreophila* [42]. They narrated that, the crude ethanol extract of the leaves possesses significant *in vivo* antimalarial activity which might be due to the phytochemicals constituents present. Another studies carried out by Oluwole and others [43] reported the presence of alkaloids, flavonoids, tannins and Saponins in the methanol extract of *G. oreophila* and exhibited a significant antibacterial activity against both gram-positive and gram-negative bacterial isolates used in their studies.

The preliminary phytochemical screening of the extract of *Securinega virosa* revealed the presence of alkaloids, flavonoids, saponins, tannins, glycosides and other important phytoconstituents [44]. The extract of *S. virosa* is believed to have possesses an analgesic and anti-inflammation as a result of alkaloids, flavonoids, tannins or saponins present [44-45].

The phytochemical screening carried out on the methanolic leaf extract of *Cissus cornifolia* revealed the presence of alkaloids, flavonoids, saponins, tannins, stilbenoids and steroids/ terpenoids [46]. The result of the research supported the use of the leaf-sap as a remedy against mental derangement. Yaro *et al.*, [47] revealed that, the methanol root bark extract of *C. cornifolia* contained flavonoids, saponins, steroids, and tannins with alkaloids and anthraquinones absence. They observed that, root bark extract of the plants exhibited anticonvulsant activity.

Boswellia dalzielii popularly known as "Ararrabi" in Hausaland is one of the plants believed to have antiulcer, antibacterial, as well as other antimicrobial activities. Hassan *et al.* [48] observed that, the stem bark of the plant *B. dalzielii* contained sterols, terpenes and carbohydrates, tannins, saponins, flavonoids, cardiac glycosides in the petroleum ether extract and methanolic extract respectively. The result indicated that the stem bark possesses antispasmodic activity and justified its use traditionally in alleviating gastrointestinal disorders. Manzo *et al.*, [49] justified the use of *B. dalzielii* in the treatment of diarrhea. The antimicrobial activity of ethanolic extracts of this plant were reported by [50-51].

Phytochemicals analysis of the root bark extract of *Acacia albidia* revealed the presence of alkaloids, flavonoids, carbohydrates, tannins and glycosides [52]. The result of the study showed that, the crude methanolic extract of the plant contained biologically active substances with hypoglycaemic activities and justified its traditional use in diabetes mellitus. Karoune *et al.*, [53] reported the antioxidant effects of the leaves and bark of *A. albidia*.

The stem bark extract of *Combretum micranthum* revealed the presence of phytochemicals constituents such as alkaloids,

flavonoids, tannins, saponins, glycosides and others [54]. The result showed that, the extract possesses antidiarrhoeal properties and suggested the use of this plants by pregnant and non-pregnant women in the management of diarrhoea. Another studies by Abdullahi *et al.*, [55] explained that, the presence of different phytochemicals constituents like alkaloids, flavonoids, saponins and tannins in the aqueous stem bark extract of *C. micranthum* may be responsible for analgesic and antiinflammatory activities observed in the studies. Chika and Bello [56] reported the significant antihyperglycemic and antidiabetic activities of the aqueous leaf extract of the plant. Reference [57] also reported a significant antihyperglycemic activity of *C. micranthum*.

Paullinia pinnata is a medicinal plant which is widely used in northern Nigeria for treating epilepsy. Maiha and co-workers [58] reported that, the aqueous methanolic stem bark extract of *P. pinnata* contains bioactive substances which possesses anticonvulsant activity that may be beneficial in the treatment of grandmal epilepsy and lend credence to the use of the plant in the management of epilepsy in traditional medicine. According to Voukeng *et al.*, [59] *P. pinnata* possess an antibacterial activity due to the presence of alkaloids, flavonoids, saponins, tannins and other compounds. Lunga *et al.*, [60] reported the antithypoid and free radical scavenging properties of methanol extracts from the aerial part of *P. pinnata*. Patience *et al.*, [61] observed the antiinflammatory activity of the aqueous extract of the leaves part of *P. pinnata*.

The phytochemical screening carried out on root extracts (acetone and methanol) of *Cassia alata* by Abdullahi *et al.*, [62] revealed the presence of flavonoids, tannins, saponins, steroids/terpenes, and stilbenoids. After several investigations on different microorganisms, the root extract of the plant showed antimicrobial activities which is due to the presence of these phytoconstituents especially flavonoids, stilbenoids and tannins. Timothy *et al.*, [63] reported the presence of flavonoids, anthraquinones, saponins, glycosides, terpenes, reducing sugars in the ethanol and aqueous extract of *C. alata*, and revealed that, the plant possess an antibacterial activity, also support the use of the plant traditionally for the management of typhoid fever and other infections. Moriyama *et al.*, [64] determined the antiinflammatory activity of the leaf extract of *C. alata*.

Burkea africana is another Nigerian medicinal plant believed to possess pharmacological properties including antioxidant, antidiarrhoeal, anticonvulsant and antimicrobial activities. Secondary metabolites like flavonoids, saponins, tannins, cardiac glycosides and other important constituents were found to be presence in the root bark extract of *B. africana* [65]. Their studies indicated that, the root bark extract have potential sedative and anxiolytic properties. Tor-anyiin and Anyam [66] reported the antibacterial activity of the root bark extract of *B. africana*. According to [67] the methanolic bark extract of *B. africana* had considerable radical scavenging activity as well as molluscidal properties and that both dichloromethane and methanol extracts of the bark were fungicidal.

Calotropis procera was reported to possess different

secondary metabolites including alkaloids [68] flavonoids, steroids, cardiac glycosides, saponins and terpenoids [69]. The root bark, leaves and flower of *C. procera* possess pharmacological activities such as antibacterial, antifungal [70], anticancer, analgesic, anticonvulsant, antitumor, antiparasitic, antioxidant, antiinflammatory and many more [69]. Reference [71] reported the traditional use of *C. procera* leaf, root and bark extract in the treatment of elephantiasis and leprosy.

Hymenocardia acida is one of the most common plants used in the treatment of sickle cell anaemia, menstrual pain, diabetes, epilepsy, hypotension and other diseases [72]. The study conducted in the stem bark of *H. acida* revealed the presence of alkaloids, flavonoids, saponins, tannins, and glycosides [72]. The result reported that, the ethanol stem bark extract of the plant possess anticonvulsant activity and suggested the ethnomedicinal use of the plant in the treatment of epilepsy of peritonal type. According to Ogbunugafor *et al.*, [73] the leaves of *H. acida* possess free radical scavenging activity and strong reducing power *in vitro*. Antiplasmodial, antitrypanosomal, antiinflammatory [74], antiulcer, anti-HIV, antitumor, antidiarrhoeal, antifertility, antiimplantation [75] have been reported.

The phytochemical screening carried out on the seed extracts of *Citrullus lanatus* showed that, alkaloids, flavonoids, reducing sugars, carbohydrates, proteins, amino acids, phenols, and phytosterol were all present [76]. The presence of these phytoconstituents in the seed extract of *C. lanatus* indicated that, the plant possess antioxidant and antimicrobial properties. According to [77-79] various parts (seeds, fruit pulp, leaves) of *C. lanatus* possess pharmacological properties such as antioxidant, antimicrobial, analgesic, antiulcer, antiinflammatory, antidiabetic and others, this may be due to the bioactive substances present.

Cassia sieberiana is widely distributed plants in northern Nigeria especially in Sokoto, Kebbi, Bauchi, Zamfara, Yobe, Borno and Adamawa, it can also be found in Oyo and Onitsha the southern part of the country [80]. The investigation carried out on the root of *C. sieberiana* revealed the presence of flavonoids, tannins and Saponins in both the methanolic and dichloromethane extracts, while alkaloids were found to be present in the methanolic extract. The result obtained indicated that, the root bark of *C. sieberiana* can be used traditionally for the treatment of diseases attributed to free radicals and microbial infections [80]. Awomukwu *et al.*, [81] investigated the presence of alkaloids, flavonoids, saponins, tannins and little amount of phenols on stem, pod and root extract of *C. sieberiana* and reported the antiulcer, antidiarrhoeal, antimalarial, antitrypanosomal and other pharmacological activities. Reference [82] reported the antimycobacterium activity of *C. sieberiana*.

The phytochemical screening and antidiarrhoeal studies conducted on the root of *Clerodendrum aculeatum* showed the presence of flavonoids, alkaloids, tannins, saponins, steroids and carbohydrates [83]. The methanolic extract of *C. aculeatum* produced a statistically significant protection against diarrhea and the pharmacological activities studied might be

responsible for the presence of the phytochemical screened [83].

The phytochemical screening of ethanolic and aqueous extracts of *Ficus asperipolia* and *Terminalia catappa* showed the presence of phenolics compounds such as alkaloids, flavonoids, glycosides, saponins and tannins [84]. The result indicated that, the plants studied possess antibacterial activity both on gram-negative and gram-positive bacterial isolates, which may be due to the presence of bioactive components. Several studies shown that *T. catappa* possess antifungal [85-88], antibacterial [86-88], antidiabetic, antiinflammatory, antioxidant, anti-HIV [86, 89], antitumor [86], anticancer [89] as well as other pharmacological activities.

The work of [2] on the leaves of 4 Nigerian medicinal plants namely; *Annona senegalensis*, *Axonopus compressus*, *Bryophyllum pinnatum* and *Heliotropium indicum* showed that alkaloids, flavonoids, tannins, saponins phenolics were present in all the plants. The result reported the use of these plants for the treatment of various diseases, including; cancer, inflammation, heart diseases, aging, fever reducing, pain relieving due to the presence of flavonoids. Their findings also reported the use of the plants for the management of hypertension, and intestinal disorders due to the presence of tannins, alkaloids, and Saponins in the plants. Other pharmacological activities of *A. senegalensis* includes antimicrobial [90-91], analgesic [92], antiinflammatory [91-92], anticonvulsant [91, 93], antifungal [94] antimalarial, anthelmintic, antioxidant, antidiarrhoeal [91]. *A. compressus* possesses antimalarial [95], antioxidant, anti-haemorrhoidal [96], antidiabetic [97]. Studies also revealed the antidiabetic [98-100], anticancer, antiulcer, antiinflammatory, analgesic, anticonvulsant [98-99], antifungal, antiviral and antiallergic [99] activities of *B. pinnatum*. In case of *H. indicum*, the pharmacological activities reported includes; antioxidant, antibacterial [101], analgesic [102, 103] antimicrobial, antifertility, antituberculosis, antitumor, anticataract, and antiparasitic [102].

The work of Mann and Ogbadoyi [34] on the stem bark extract of *Acacia nilotica*, *Bombax buonopozense*, *Pterocarpus erinaceus*, *Zanthoxylum zanthoxyloides*, the whole plant extract of *Heterotis rotundifolia* and round fruit extract of *Terminalia avicennioides* showed the presence of tannins, saponins, carbohydrates and terpenes. Alkaloids were found to be present in *B. buonopozense* only and flavonoids were present in all the plants except *B. buonopozense*. The result revealed the antitrypanosomal activity of *A. nilotica*, *B. buonopozense* and *H. rotundifolia*. The result also showed that, the stem bark extracts of *P. erinaceus*, *T. avicennioides* and *Z. zanthoxyloides* exhibited trypanostatic effects and could not clear the parasites completely. Irshad and Co-authors [104] reported the *in vitro* antibacterial activity of *A. nilotica* against the four bacterial strains. Significant antiviral, antifungal, antimalarial [105], antibiotic, antibacterial, antioxidant, antidiarrhea, analgesic, antiinflammatory, antispasmodic [105] activities of *A. nilotica* were reported. The methanolic leaf extracts of *B. buonopozense* indicated the antibacterial [106] activities. According to [107], the stem bark extract of *B.*

buonopozense has analgesic, antiinflammatory and antipyretic activities, and thus confirmed the traditional use for the treatment of pain, inflammation, and feverish conditions. Another study by [108] on the stem bark of *P. erinaceus* reported the antidiarrhoeal properties. Noufou *et al.*, [109] revealed the antioxidant and antiinflammatory activities of the root bark extract of *P. erinaceus*. Several researches have found that, the leaves [110-111], and stem bark [112] of *Z. zanthoxyloides* contained secondary metabolites, which are responsible for antioxidant [111-112], antidiabetic and hypolipidaemic activities. Crude methanolic extract of the *T. avicennioides* root bark exhibited broad growth inhibition against microbes causing infectious diseases [113-115]. Mann [116-117] also reported the significant exhibition of antimycobacterial activity of *T. avicennioides*. The analysis of [118] describes the antibacterial properties of the aqueous and ethanolic extracts of *H. rotundifolia*, which revealed a remarkable activity of these extracts against the tested strains.

The stem and leaves of *Cleome rutidosperma*, *Emilia coccinea*, *Sida acuta* and *Tridax procumbens* showed the presence of alkaloids, and flavonoids, [119]. Saponins and

tannins were found to be present in all the plants except in stem and leaf of *S. acuta*. According to [120] *T. procumbens* is known for several potential therapeutic properties including antiviral, antiinflammatory antibiotic efficacies, antimicrobial among others. Chika *et al.*, [121] reported that the leaves and stem extract of *E. coccinea* exhibited anticonvulsant, antioxidant, and antiinflammatory activities. The investigation of [122] suggested that the aqueous leaves extract of *C. rutidosperma* exhibits antihyperlipidaemic, antihyperglycaemic, antioxidant potentials, and consequently could prevent various complications of diabetes. The leaves of *S. acuta* were found to possess antioxidant, antidiarrhoeal, antimalarial and also used for the treatment of headache, fever and worm infestation [123].

The phytochemical screening of the ethanol leaf extract of *Uvaria chamae* revealed the presence of saponins, tannins, flavonoids, alkaloids, terpenoids, carbohydrates, cardiac glycosides and others [124]. The result showed that, the plant possess an antiparasmodial activity due to the presence of these phytoconstituents mentioned above.

Table 1. Nigerian medicinal plants.

| Botanical name | Local name | Family | Part used | References |
|--------------------------|------------------|-----------------------|--|-----------------|
| <i>A. albida</i> | Gawo | Fabaceae (Mimosaceae) | Leaves, stem, and root bark | 52, 125 |
| <i>A. compressus</i> | | Poaceae | Root and leaf | 95 |
| <i>A. nilotica</i> | Bagaruwa | Caesalpiniaceae | Bark | 126, 127 |
| <i>A. senegalensis</i> | Gwandar daji | Annonaceae | Root, stem bark | 90,92-93 |
| <i>B. Africana</i> | Bakin makarho | Fabaceae | Stem and root bark | 65, 125-128 |
| <i>B. buonopozense</i> | Gurjiya | Malvaceae | Leaves | 34, 129 |
| <i>B. dalzielii</i> | Ararrabi | Burseraceae | Leaf and stem bark | 48,125, |
| <i>B. pinnatum</i> | | Crassulaceae | Leaf | 99, 126 |
| <i>C. alata</i> | Raidore | Caesalpiniaceae | Leaf and root | 62-64 |
| <i>C. sieberiana</i> | Malga | | Root bark | 80 |
| <i>C. aculeatum</i> | Mashayi | Verbenaceae | Leaves | 83, 129 |
| <i>C. micranthum</i> | Farar geza | Combretaceae | Stem bark and leaf | 54-57 |
| <i>C. rutidosperma</i> | | Capparidaceae | Leaves and stem | 119, 129 |
| <i>C. lanatus</i> | Kankana | Cucurbitaceae | Seeds | 76, 78 |
| <i>C. procera</i> | Tumfafiya | Asclepiadaceae | Flower, dry latex, leaf exudate | 69-70, 126, 130 |
| <i>C. cornifolia</i> | | Vitaceae | Leaf and root bark | 46-47 |
| <i>F. asperipolia</i> | | | Leaves | 84 |
| <i>F. sycomorus</i> | Baure | Moraceae | Root | 40-41, 125 |
| <i>G. oreophila</i> | Kauci | Loranthaceae | Leaf | 42-43 |
| <i>H. acida</i> | | Euphorbiaceae | Stem bark | 72, 74-75 |
| <i>H. indicum</i> | Kalkashin korama | Boraginaceae | Whole plant | 102-103, 129 |
| <i>H. rotundifolia</i> | | Melastomataceae | whole plant | 129 |
| <i>L. hastate</i> | Yadiya | Asclepiadaceae | Leaf | 35,36,37, |
| <i>P. erinaceus</i> | Madobiya | Fabaceae | Leaves, Root and stem bark | 108-109, 129 |
| <i>P. pinnata</i> | Yatsabiyar | Sapindaceae | Aerial part and dried leaves, leaf juice | 60-61, 129 |
| <i>S. virosa</i> | | Euphorbiaceae | Leaves | 44-45 |
| <i>S. acuta</i> | | Malvaceae | Leaves and stem and whole herb | 119, 129, 131 |
| <i>T. avicennioides</i> | Baushe | Combretaceae | Fruit | 34, 125 |
| <i>T. catappa</i> | | Combretaceae | Leaf, wood and bark | 85, 87 |
| <i>T. procumbens</i> | Magaja | Combretaceae | Leaves and stem | 119, 125 |
| <i>U. chamae</i> | Kaskaifi | Annonaceae | Leaves | 124 |
| <i>Z. zanthoxyloides</i> | Fasakauri | Rutaceae | Leaves, roots and stem bark | 34, 129 |

Table 2. Phytochemicals constituents of Nigerian medicinal plants.

| Species | Alkaloids | Flavonoids | Saponins | Tannins | References |
|--------------------------|-----------|------------|----------|---------|------------|
| <i>F. sycomorus</i> | + | + | + | + | 40-41 |
| <i>G. oreophila</i> | + | + | + | + | 42-43 |
| <i>S. virosa</i> | + | + | + | + | 44 |
| <i>C. cornifolia</i> | + | - | + | + | 47 |
| <i>B.dalzielli</i> | - | + | + | + | 48 |
| <i>Acacia albida</i> | + | + | - | + | 52 |
| <i>C. micranthum</i> | + | + | + | + | 54-55 |
| <i>P.pinnata</i> | + | + | + | + | 58-59 |
| <i>C. rutidosperma</i> | + | + | + | + | 119 |
| <i>E. coccinea</i> | + | + | + | + | 119 |
| <i>S. acuta</i> | + | + | - | - | 119 |
| <i>B. buonopozense</i> | + | - | + | + | 34 |
| <i>P. erinaceus</i> | - | + | + | + | 34 |
| <i>H. rotundifolia</i> | - | + | + | + | 34 |
| <i>A. nilotica</i> | - | + | + | + | 34 |
| <i>C. aculeatum</i> | + | + | + | + | 83 |
| <i>T. procumbens</i> | + | + | + | + | 119 |
| <i>A. compressus</i> | + | + | + | + | 2 |
| <i>C. alata</i> | - | + | + | + | 62-63 |
| <i>B.africana</i> | - | + | + | + | 65 |
| <i>U. chamae</i> | + | + | + | + | 124 |
| <i>C. procera</i> | + | + | + | - | 68-69 |
| <i>H. acida</i> | + | + | + | + | 72 |
| <i>C. lanatus</i> | + | + | - | - | 76 |
| <i>L. hastate</i> | + | + | + | + | 35-39 |
| <i>F. asperipolia</i> | + | + | + | + | 84 |
| <i>T. catappa</i> | + | + | + | + | 84 |
| <i>A. senegalensis</i> | + | + | + | + | 2 |
| <i>C. sieberiana</i> | + | + | + | + | 80 |
| <i>T. avicennioides</i> | - | + | + | + | 34 |
| <i>Z. zanthoxyloides</i> | - | + | + | + | 34 |
| <i>B. pinnatum</i> | + | + | + | + | 2 |
| <i>H. indicum</i> | + | + | + | + | 2 |

5. Conclusion

Medicinal plants are a plant which, in one or more of their organs, contains substances that can be used for therapeutic purposes or which are precursors for chemo-pharmaceutical semi synthesis. Several parts of plants were reported to possess different secondary metabolites which may be beneficial, or toxic to both plants and animals when consumed in excess amount. Nigeria is naturally blessed with both savannah and tropical rainforests vegetation and these offer a wide distribution of plants believed to possess secondary metabolites which are responsible for treating or curing various diseases. Several researches have been carried out in order to explore and identify the chemical compositions responsible for various pharmacological effects in Nigerian medicinal plants. This review work found out that, the Nigerian medicinal plants exhibited significant pharmacological activities such as antibacterial, antidiarrhoeal, antidiabetic

antioxidant, anticancer, antitumor, antiulcer, anticonvulsant as well as other important pharmacological activities. The observed pharmacological properties are due to alkaloids, flavonoids, saponins, tannins and many more phytoconstituents in the plants studied.

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