

Nigerian Plants with Anti-Inflammatory and Antifungal Potential

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Abstract

Medicinal plants have been the popular remedy to treat different types of disease for a long term. This paper reviews some Nigerian plants and their main constituents which possess anti-inflammatory activities, this provides a brief overview on quick and early reading on the role and actions of these medicinal plants and their main constituents in inflammatory diseases. These Nigeria anti-inflammatory plants include *D. cinerea*, *F. iteophylla*, *Alafia barteri*, *Combretum mucronatum* and *Capparis thoningii* Schum, *Zingiber officinate*, *Cassia occidentalis* and *Moringa oleifera*. The inflammatory properties of these plants will provide additional information on therapeutic approaches for the various inflammatory conditions. Fungi which are microbial entities are not exempted from the problem of antimicrobial resistance. Most common fungicidal agents are becoming ineffective in treating fungal infections. Hence, the search for antifungal agents has double paced recently. Plants with antifungal agents are *Ocimum gratissimum*, *Acalypha wilkesiana* (Muell Arg.), *Funtumia elastica* (Preuss), *Anogeissus leiocarpus*, *Terminalia avicennoides*, *Mallotus oppositifollius*, *Ssystasia gangetica*, *Carica papaya* and *Diodia scandens*. This paper elucidates Nigerian plant with anti-inflammatory and antifungal potentials.

Keywords: Antimicrobial, anti-inflammatory, anti-fungal

INTRODUCTION

Inflammation is a physiological response to injury as a result of stimuli such as cell damage, pathogenic infections and chemical toxicity [1]. Anti-inflammation is a protective measures taken by animals against cell damage, the wearing of tender cartilage and swollen of joint caused by inflammation [1]. Inflammation inhibit enzyme; cyclo-oxygenase, leading to inhibition of prostaglandin synthesis. Prostaglandin is produced by tissue macrophage [2]. Different Nigerian plants shows anti-inflammatory effects and various compositions of phytochemicals, which include; tannin, saponin, cardiac glycosides, flavonoids and alkaloid [2].

There can be some initial indicators of inflammation: pain, redness, heat or warmness and swelling. If there is wound to any part human body, the arterioles in

the encircling tissue dilate. This caused to blood circulation towards the area (redness). In the report of Burke *et al.* (2005), [3] inflammation is may be acute or chronic inflammation. Acute inflammation may be a starting response of the body to harmful stimuli. In chronic inflammation, the inflammatory response is out of proportion resulting in damage to the body. Cyclooxygenase (COX) is the key enzymes in the synthesis of prostaglandins, prostacyclins and thromboxanes which are involved in inflammation, pain and platelet aggregation. Pilotto *et al.* (2010) reported that steroidal and non-steroidal anti-inflammatory drugs (SAIDs and NASIDs, respectively) are currently the most widely used drugs in the treatment of acute inflammatory disorders, despite their renal and gastric negative secondary effects [4]. These drugs block COX-1 and COX-2

enzyme activity. COX enzymes assist with prostaglandin production. NSAIDs, steroidal anti-inflammatory drugs are being used till now, as a result of long term uses of these drugs cause adverse side effects and damage human biological system such as liver, gastrointestinal tract, etc. As a result of adverse side effects, like gastric lesions, cardiovascular, renal failure [5] and gastrointestinal damage [6, 7].

Now there is a need for the new safe, potent, nontoxic or less toxic anti-inflammatory drug. In many developing countries the plant medicines have most important role in primary healthcare. On the basis of World Health Organization (WHO) study, the 80% of the world population mainly depend upon plant-based drugs. In Ayurveda, Siddha, and Unani, utilizing a large number of medicinal plants were used for the treatment of human diseases [8].

Plants have the ability to synthesize a wide verity of phytochemical compounds as secondary metabolites. Many of the phytochemicals have been used to effectively treat the various ailments for mankind. Mahesh and Sathish (2008), [9] reported that World Health Organization has made an attempt to identify all medicinal plants used globally and listed more than 20,000 species. Many parts of the medicinal plant are used as raw drugs and they possess varied medicinal properties. Plants have a great potential for producing new drugs and used in traditional medicine to treat chronic and even infectious diseases.

Fungi is any member of the group of eukaryotic organisms that includes microorganisms such yeast and mold as well as more familiar mushrooms. In the report of Arif *et al.* (2009) [10], fungi which are microbial entities are not exempted from the problem of

antimicrobial resistance. Most fungi have developed resistance to commonly available fungicidal agents. For instance, the broad-spectrum drug amphotericin B was the sole drug for nearly 30 years, and it is one of the few drugs that actually kill fungal cells, but can cause significant nephrotoxicity in the patients.

According to Bhadauria and Kumar (2011) [11], plants have a long history of antibiotic usage for the cure of disease caused by microbial agents, including viral, bacterial, and fungal agents. Despite the efforts of researchers in screening plants for their antifungal property, there are still so many plants that are yet to be assessed for their antifungal property and this require more careful investigation to reveal their hidden characteristics. Humans have utilized relatively 1–10 % of the estimated 250,000–500,000 species of plants on Earth [12]. In essence, 90 % of these plants are yet to be utilized. Specifically, a lot of these yet to be investigated plants with potential antifungal properties are still in the wild in Nigeria and most West African Countries. Scientific documents of the identities and antifungal properties of these plants are still scanty. Natural products have been the single most productive source of leads for the development of drugs [13]. Generally, natural products from plants are more preferred, because they are harmless or have minimum side effects when compared to synthetic drugs.

Nigerian Plants with Anti-Inflammatory Potentials

Zingiber officinate

In the study of Shimoda *et al.* (2010) [14], *Zingiber officinale* was investigated to have anti-inflammatory potential and prepared 40% ethanolic extract from dried red ginger and evaluation of its anti-inflammatory potential was carried out using acute and chronic inflammation models. This result obtained was found to

have a potent suppressive effect on acute and chronic inflammation, and inhibition of macrophage activation seems to be involved in this anti-inflammatory effect. The report of Arun *et al.* (2014) [15], shown that *Zingiber officinale* are used as edible roots in some part of northern Nigeria, cuisine is applied as an irrigant or intracanal medicament against *E. faecalis* in endodontic practice.

***Cassia occidentalis* (Caesalpinaceae)**

Sreejith *et al.* (2010) [16], evaluated anti-inflammatory potential of whole plant of *Cassia occidentalis* using ethanolic extract. For investigation of anti-inflammatory potential, 250 mg/kg dose was taken and using carrageenan induced paw edema model. The result revealed that significant reduction in malondialdehyde levels of murine hepatic microsomes and significantly reduced carrageenan induced inflammation in mice at a dose of 250 mg/kg. Pharmacological investigation of *Cassia occidentalis* have revealed the presence of several therapeutic activities, anti-inflammatory, antipyretic and anti-diabetic properties.

***Moringa oleifera* (Moringaceae)**

In the report of Chandrashekar *et al.* (2010) [17], the aqueous and ethanolic extract of the stem bark of *Moringa oleifera* showed % inhibition after 5 h was maximum 27.27 and 30.30% significant reduction $P < 0.01$ and $P < 0.05$ in the edema volume at a dose of 300 mg/kg body weight, which is comparable to standard drug Diclofenac sodium. The standard drug showed % inhibition 44.44% (25 mg/kg) body weight and significant value $P < 0.01$. The percentage of paw edema was found to be better with the alcoholic extract than the aqueous extract. Xianjuan *et al.* (2018) [18], mentioned that *Moringa oleifera* possesses a wide range of medicinal and therapeutic properties through executing its potent anti-inflammatory activity. *Moringa oleifera*

can reduce the risk of cancer and modulate blood glucose.

D. cinerea* and *F. iteophylla

The significant inhibitory effects against the carrageenan edema at all the phases of inflammation and was observed to be comparable to the results suggest that all the crude saponin extracts tested demonstrated significant anti-inflammatory activity that might be mediated through the inhibition of the release and synthesis of the agents that are involved in inflammation (prostaglandin). It has been reported that the biological activities of saponins from medicinal plants are linked to their amphiphilic nature, helping in exhibiting these activities via their capability to intercalate into the plasma membrane culminating in changes in membrane fluidity that in turn affect membrane function, thus bringing about cellular responses [19].

***Alafia barteri*, *Combretum mucronatum* and *Capparis thoningii* Schum**

Ishola *et al.* (2014) [20], examined anti-inflammatory effects of the methanolic root extracts of selected Nigerian medicinal plants. Three plants that are used in the treatment of pain and inflammatory conditions by traditional healers were assessed, which include *Alafia barteri*, *Combretum mucronatum*, and *Capparis thoningii* Schum. Phytochemical screening of the plants shows the presence of alkaloids, saponins, glycosides, cardiac glycosides, and steroidal nucleus. According to traditional healers, fresh roots of the three plants were collected, identified, and processed [21]. The extracts of the plants were dissolved in 0.5% v/v dimethylsulfoxide in physiological saline and were administered to the animals (Sprague–Dawley male rats) by oral gavage [22]. Results from the research report showed that acute oral administration of the three medicinal plants elicited anti-inflammatory effects,

and following toxicity test, the extracts from the three plants were considered safe when administered through oral route. It was concluded that the presence of the phytochemicals in the extracts may be associated with the anti-inflammatory potentials of the extracts from the three medicinal plants [20].

Nigerian Plants with Antifungal Potentials

Ocimum gratissimum

According to Morales and Simon (1996) [23], who reported that bioactive present in extracts of *Ocimum* possess insecticidal, nematocidal, fungicidal, and generally antimicrobial activities. This plant belongs to the family lamiaceae and is very rich in aromatic compounds and essential oils. Amadi *et al.* (2010) [24], reported the Antifungal activity of *Ocimum* extract on *Aspergillus repens*, *Curvularia lunata*, and *Fusarium moniliforme* Water, ethanol, and acetone extracts of *Ocimum* impaired radial growth of the three fungi, *A. repens*, *C. lunata*, and *F. moniliforme* [24]. The report of Anejionu *et al.* (2012) [25], indicated that the ethanolic extract of *Ocimum gratissimum* oil have antifungal activity against moulds and candida albicans. The killing rate study indicated also that the oil has very good activity against the isolates. The killing kinetics showed that the extract started killing the tested isolates completely from 2 hours and upwards.

The plant extracts of *Ocimum gratissimum* exhibits antifungal activities against toxigenic *A. flavus*. Extracts of the plant could be useful in the treatment of fungal infections caused by *A. flavus* [26].

***Acalypha wilkesiana* (Muell Arg.)**

Acalypha wilkesiana belongs to the Euphorbiaceae family. In the report of Oliver (1959) [27], the leaf of *Acalypha wilkesiana* is used for treating Pityriasis versicolor, Tinea versicolor, and other

similar skin infections. Antimicrobial activity of *Acalypha* species has been linked to the presence of phytochemical such as geranin, corilagin, and gallic acid [28]. *Acalypha wilkesiana* ointment was very efficacious in the treatment of Tinea pedis, Pityriasis versicolor, and Candida intertrigo where the cure rate was 100% in each condition. The metabolic leaf extracts of *A. wilkesiana* has a broad spectrum of activity against bacteria (Gram-positive and negative) and fungi (yeast and molds) of clinical origin [29].

***Anogeissus leiocarpus* (DC.) Guill and Perr**

Anogeissus leiocarpus is a tall evergreen tree native to savannas of Tropical Africa. It is from family, Combretaceae. It is mainly used in traditional medicine as a remedy for much disease of livestock and man, which include helminthosis, schistosomiasis, leprosy, diarrhea, and psoriasis [30-31]. In the study conducted by (Mann *et al.*, 2008) [32] the antifungal activity of chloroform, ethanolic, methanolic, ethyl acetate, and aqueous root extracts of *Anogeissus leiocarpus* against *A. niger*, *Aspergillus fumigatus*, *Penicillium species*, *Microsporum audouinii*, and *T. rubrum* using radial growth technique. The report of Mann *et al.* (2008) [33], shown that the aqueous ethanolic, methanolic, chloroform and ethylacetate extract of *Anogeissus leiocarpus* exhibit antifungal activity against *Aspergillus niger*, *Aspergillus fumigatus*, *Penicillium species*, *M. audouinii* and *T. rubrum*. It was revealed in this study, that increase in the fungal activity of the extracts was enhanced by increase in the concentration of the extracts.

***Terminalia avicennoides* Guill and Perr**

The tree of *Terminalia avicennoides* is abundant in the Savannah region of West Africa. Ethnomedicinal uses of the plant cover various medical conditions. The

powered roots of *Terminalia avicennoides* are used for treating wounds and ulcers and a root decoction is used for the treatment of gastrointestinal disorders [34]. According to (Mann *et al.*, 2008) [33], who reported that chloroform, ethanolic, methanolic, ethyl acetate, and aqueous root extracts of *Terminalia avicennoides* have antifungal activities against *A. niger*, *A. fumigatus*, *Penicillium* species, *Microsporum audouinii*, and *T. rubrum*, using radial growth technique. He also stated in his study, minimum inhibitory concentration (MIC) of the extracts ranged between 0.03 and 0.07lg/ml while the minimum fungicidal concentration ranged between 0.04 and 0.08 lg/ml. The major phytochemicals present in *T. avicennoides* are saponins, tannins, and glycosides. The report of Sharma *et al.* (2018) [36], found the leaves extract of *Terminalia avicennoides* to possess high antifungal activity against *Aspergillus* spp.

***Funtumia elastica* (Preuss)**

Funtumia elastic belongs to the family Apocynaceae, it is a medium-sized African rubber tree with glossy leaves, milky sap, and long woody seedpods. The genus consists of two common species: *F. elastica* (female) and *F. africana* (male) [37]. The decoction of the leaf is used as a cure for mouth and venereal diseases [39]. Phytochemical screening of *F. elastic* contains anthocyanins, butacyanin, flavonoids, steroids, and tannins. *F. elastica* also exhibited pronounced antifungal activity *Aspergillus flavus*, *C. albicans*, *Microsporum audouinii*, *Penicillium* sp., *Trichophyton mentagrophytes*, *Trichoderma* sp, and *Trichosporon cutaneum* [37]. According to Adekunle (2006) [38], who reported that aqueous and ethanolic extracts of *funtumia elastica* exhibited significant antifungal activity on the most of the fungi species.

Mallotus oppositifolius

Mallotus oppositifolius belongs to the family Euphorbiaceae. The twig of the

plant is used as chewing sticks for cleaning the teeth, the stem is used as yam stakes. Phytochemical screening of *M. oppositifolius* revealed the presence of secondary metabolites such as alkaloids, phenols, flavonoids, anthraquinones, and cardenolides. Higher concentration of these phytochemicals resides in the leaves than in the root [40]. The leaves of *M. oppositifolius* are used in preparing antimalarial and antiinflammatory remedies. The antifungal property of aqueous and ethanol extracts of *M. oppositifolius* against fungi such as *A. flavus*, *C. albicans*, *Microsporum audouinii*, *Penicillium* sp., *T. mentagrophytes*, *Trichoderma* sp. and *Trichosporon cutaneum* was reported by [38].

***Asystasia gangetica* (Linn) T. Anders.**

Asystasia gangetica is an ascending, branched, quadrangular fast growing plant with stem up to 2 m long and roots at lower nodes and it belongs to the family Acanthaceae. According to (Hamid *et al.*, 2011) [41], the hexane, ethylacetate, and methanol extracts showed antifungal activities against *C. albicans*, *Penicillium notatum*, *T. rubrum*, and *Epidermophyton floccosum* with activity comparable to that of the reference drug, Tioconazole. The MIC of the plants against the fungi ranged from 6.25 to 200 mg/ml and the extracts of this plant contain saponins, reducing sugar, steroids, glycosides, flavonoids, and anthraquinones.

Carica papaya

Carica papaya belongs to the family Caricaceae. It is a cultivated tropical fruit tree. The fruit of the plant is Pawpaw. Papaya seed could be used as an antibacterial agent for *Escherichia coli*, *Staphylococcus aureus*, and *Salmonella typhi* (Yismaw *et al.*, 2008). Methanol extracts of leaves of *Carica papaya* at 20, 40, 60, and 80% concentrations had been reported to possess fungi toxic components

that retarded the mycelia growth of *Alternaria solani*, isolated from rotting yam tubers [42]. In the study of Maregesi *et al.* (2008) [43], ethanolic leaf extracts of *Carica papaya* are potential source of secondary metabolites with antifungal properties on *Fusarium spp.*

Diodia scandens

Diodia scandens is a straggling herb with a taproot, slender stem, and compound leaves used for treatment of various diseases, it belongs to the family Rubiaceae. [44]. *D. scandens* leaves are used for curing eczema (antifungal property), as fodder to poultry, its juice is used to stop bleeding, its extract is used to treat bruises and minor cuts and drunk as tonic during treatment of ear problems, it is also used as antiabortifacient [45]. Phytochemical screening of the leaf of *D. scandens* revealed the presence of saponins, tannins, cardiac glycosides and absence of flavonoids, phlobatannins, alkaloids, and anthraquinones [44]. *Diodia scandens* possess a bioactive principle on a wide array of dermatophytes and other skin diseases. It possesses antifungal agent for the management of various skin diseases in Nigeria and African countries [46].

CONCLUSION

Natural products of plant origin still remain the main source of novel compounds that can solve the problem of drug resistance posed to currently available drugs by microbial agents. The yet to be screened plants are therefore a source to get for new chemo types for drug development in antifungal therapeutics. Antifungal agents that are currently available are costly and therefore unaffordable to poor peasants in the developing world. The Plant extracts are easily available affordable and safer to common men. Plants provides thousands of new useful phytochemicals of great diversity, they inhibitory effects on all

types of microorganisms in vitro. Findings from the current study will set a good foundation for the recent and future researchers in the development of novel bioactivities against inflammation and fungal pathogens.

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