



REVIEW MANUSCRIPT: A REVIEW OF SOME AFRICAN MEDICINAL PLANTS.

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ABSTRACT

This aim of this study is to review naturally occurring dietary chemotherapeutic bioactive agents in some african medicinal plants that can be put to therapeutic use in combating inflammation and carcinogenesis without posing any deleterious effects to normal cells, tissues, organs and systems. Flavonoids possess antioxidant activity and may play a beneficial role in cancer prevention, and offer some protection against diabetes and atherosclerosis. Polyphenol prevents oxygen free radical-induced hepatocyte lethality, prevent lipopolysaccharide-induced liver injury through inhibition of inducible nitric oxide synthase and tumor necrosis factor- α expression and inhibits carcinogen or toxin-induced liver oxidative DNA damage. Acetogenins have cytotoxic properties against tumor cell lines. Cardiac glycosides helps in the treatment of congestive heart failure. Tannins exert antimicrobial activities by iron deprivation, hydrogen bounding or specific interactions with vital proteins such as enzymes in microbial cells. Terpenoid have hepatoprotective effects in albino rats.

KEYWORDS : Anti-tumorigenic, anti-inflammatory, antioxidants, free radical, phytochemicals, scavenging



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INTRODUCTION

More than 80% of the world's population need, to prevent and treat their diseases depends upon traditional medicine¹. Therefore, attention to traditional medicine and the use of medicinal plants is being widespread and plants still represent the largest source of natural antioxidants and antimicrobial components². Currently, widely use of medicinal and aromatic plants, as antioxidants in food and drug industries in the world, is widespread³. Synthesis or modification of known drugs continues as an important aspect of research. However a vast amount of synthetic work has contributed relatively small improvements over the prototype drugs. Hence, there is a continued need for new prototype drugs and the new templates to use in the design of potential chemotherapeutic agents are significantly being provided by natural products. An avalanche of dietary and plant-derived compounds has been reported to possess anti-carcinogenic activities. Most of these agents possess intrinsic antioxidant, radical trapping and anti-inflammatory properties, which appear to contribute to their chemopreventive properties⁴. It is considered important to screen apoptotic inducers from plant origin, either in the form of crude extracts or as components isolated from them. The search for plant-derived antioxidants has received much attention and effort in order to identify the compounds that has high capacity in scavenging free radicals related to various diseases⁵. Generally, antioxidant compounds like phenolic acids, polyphenols and flavonoids scavenge free radicals such as peroxide, hydroperoxide of lipid hydroxyl and thus inhibit the oxidative mechanisms that lead to degenerative diseases. Epidemiologists have observed that a diet rich in polyphenolic compounds may result in a positive health effect attributed to its antioxidants properties⁶. Many medicinal plants contain large amounts of antioxidant and antimicrobial constituents such as phenols and flavonoids. Phenolic

compounds exhibit a wide range of physiological properties such as anti-inflammatory⁷, anti-mutagenic⁸, antimicrobial⁹, antioxidant¹⁰, anti-thrombotic, cardioprotective, and vasodilatory effects¹¹. Polyphenols have been shown to exert important antioxidant effects against free radicals and lipid peroxidation via several mechanisms¹². Flavonoids are another group of secondary metabolites which are widely distributed in plants. Interestingly, the antioxidant activity of many flavonoids such as quercetin, luteolin, and catechins is higher than that of some well-known compounds, e.g., vitamins C and E, and β -carotene¹³. Besides, flavonoids such as apigenin and luteolin are active against methicillin-resistant *Staphylococcus aureus*¹⁴. The search for anti-cancer agents from plant sources started in earnest in the 1950s with the discovery and development of the vinca alkaloids, vinblastine and vincristine and the isolation of the cytotoxic podophyllotoxins, but the development of new screening technologies led to the revival of collections of plants and other organisms in 1986, with a focus on the tropical and sub-tropical regions of the world¹⁵. The present study reviews some medicinal plants with great antioxidants and phytochemicals that may help in scavenging free radicals and oxidative stress.

A). *VERNONIA AMYGDALINA*

Vernonia amygdalina is a small shrub with green leaves, a characteristic odour and bitter taste. It contains alkaloids and flavonoids¹⁶. It is commonly known as "bitter leaf" in Nigeria because the leaves and the stem have an astringent bitter taste. In Sudan, *Vernonia amygdalina* locally called gharib elwadi is grown widely in the western part of the country and principally used as medicines¹⁷. The root extract is used for relief of stomach pain, skin infections, as anthelmintic, and against leishmaniasis¹⁸ and also the wood is widely used for fuel¹⁷. In some parts of Africa the

macerated leaves of *Vernonia amygdalina* are used in making soup while the water extract serves as a tonic drink for the prevention of certain illnesses¹⁹. In Tanzania *Vernonia amygdalina* has been reported for its use by wild chimpanzees for the treatment of parasite-related diseases²⁰. The plant has acquired special relevance recently, haven been proved in human medicine to possess potent antimalarial and antihelminthic properties²¹ as well as antitumorigenic properties²². Pharmacological studies have also shown that the leaf extract has both hypoglycaemic and hypolipidaemic properties in experimental animals and so could be used in managing diabetes mellitus²³. Phytochemical screening of the plant has revealed the presence of saponins, glycosides and tannins, which are known to be bioactive purgative principles²⁴. Flavonoids are also present in bitter leaf and Igile *et al.*²⁵ have identified three flavones – luteolin, luteolin 7-O-beta-glucuronoside and luteolin 7-O-beta-glucoside. These flavones possess antioxidant activity and may play a beneficial role in cancer prevention, and offer some protection against diabetes and atherosclerosis²⁶. Also, the high content of the antioxidant vitamin C present in *Vernonia amygdalina* leaves²⁷ may play a role in these. The biologically-active compounds of *Vernonia amygdalina* are saponins and alkaloids²⁸; terpenes, steroids, coumarines, flavonoids, phenolic acids, lignans, xanthenes and anthraquinones; edotides; tannins²⁹⁻³⁰; and sesquiterpene lactone³¹. These compounds isolated from *Vernonia amygdalina* extracts, using various solvents of different polarity indexes, have been attributed to specific biological activities. For example: the antiplasmodial (anti-malarial activity) of *Vernonia amygdalina* extracts may be related to the presence of flavonoids, saponins, alkaloids²⁸. Some studies have associated coumarines and flavonoids in most plants with antitumor activities in humans³². Other cancer-fighting agents in *Vernonia amygdalina* extracts may include sesquiterpene lactones (SLs) and edotides. Terpenoid extracts from

Vernonia amygdalina have been demonstrated to have hepatoprotective effects against Carbon tetrachloride induced liver damage in rats. Arhoghro *et al.*³³ reported that aqueous extracts of *Vernonia amygdalina* del had hepatoprotective effects against Carbon tetrachloride induces liver damage in albino rats.

B). CAMELLIA SINENSIS VAR ASSAMICA

Green tea is mainly produced from the *Camellia sinensis var sinensis*. The *Camellia sinensis var assamica* has a too high content of polyphenols, which could make green tea to be excessively bitter. Depending on the manufacturing process tea produced from *camellia sinensis* can be classified into three major groups which are green tea, oblong tea, and black tea³⁴⁻³⁵. The green tea is non-fermented and hence produced by steaming and drying the leaves to inactivate polyphenol oxidase thereby preventing oxidation. The oblong tea is semi-fermented and hence produced when the fresh leaves are subjected to a partial fermentation stage before drying. On the other hand the black tea is fermented hence the leaves are allowed to undergo a post-harvest fermentation stage before drying and steaming. The fermentation of black tea is due to an oxidation catalysed by polyphenol oxidase. Green tea originates from China and has become associated with many cultures in Asia from Japan to the Middle East. Green tea leaves contain three main components which act upon human health. These includes polyphenolic compounds, xanthine bases (caffeine, and theophyllin), essential oils³⁴. Green tea components exert many biological effects, including antitumor and cancer preventive activities³⁶. Animal studies have shown that green tea inhibits carcinogenesis of the liver, skin, oral cavity, lung, stomach and other organs³⁷. In some studies, the inhibition correlated with an increase in tumor cell apoptosis and a decrease in cell proliferation³⁸. Today green tea is accepted as a cancer preventive on the basis of numerous *in vitro*, *in vivo* and epidemiological studies³⁴. Green tea

polyphenol prevents oxygen free radical-induced hepatocyte lethality, prevent lipopolysaccharide-induced liver injury through inhibition of inducible nitric oxide synthase and tumor necrosis factor- α expression and inhibits carcinogen or toxin-induced liver oxidative DNA damage³⁹. The protective effects of tea extracts or tea polyphenol against liver fibrosis and liver cirrhosis in rats have been reported⁴⁰. The polyphenols contained in the tea are anti-mutagenic and anti-carcinogenic by inhibiting cancer cell proliferation and induction of apoptosis⁴¹. They have also been found to help reduce chromosomal damage during mutagen exposure⁴². Green tea catechin, act as an antioxidant scavenger of reactive oxygen species such as superoxide, hydroxyl radicals, inhibition of lipid peroxide and inhibition of 2-deoxyguanosine oxidation in DNA to 8-hydroxy-2-deoxyguanosine. Green tea contains enzymes, proteins, carbohydrates such as cellulose, pectins, glucose, fructose, and sucrose; amino acids such as glutamic acid, tryptophan, glycine, serine, aspartic acid, tyrosine, valine, leucine, threonine, arginine, and lysine. It also contains minerals and trace elements such as calcium, magnesium, chromium, manganese, iron, copper, zinc, molybdenum, selenium, sodium, phosphorus, cobalt, strontium, nickel, potassium, fluorine, and aluminum; and trace amounts of lipids, sterols, vitamins (B, C, E), caffeine, theophylline, pigments and volatile compounds⁴³. These may account for its many protective effects on the tissues of the body. A growing body of evidence suggests that moderate consumption of green tea instead of over consumption may protect, against several forms of cancer, cardiovascular diseases, and bacterial infections.

C.) *ANNONA MURICATA*

Annona muricata is also known as soursap, guanábana, graviola, sirsak, zuurzak, coração-da-índia, guyabano or corossol. Soursop or in scientific name, *Annona muricata* L. is one of the exotic fruits prized for its very pleasant, sub-acid, aromatic and juicy flesh. Soursop

(*Annona muricata*) belongs to the family Annonaceae, and it is wide spread in the tropics and frost-free subtropics of the world⁴⁴. The fruit makes an excellent drink or ice cream after straining. Its white edible pulp contains 80% water, 1% protein, 18% carbohydrate and fair amount of vitamins B₁, B₂, and C⁴⁵. Traditionally, the leaves are used for headaches, insomnia, cystitis, liver problems, diabetes, hypertension and as an anti-inflammatory, anti-spasmodic and anti-dysenteric⁴⁶. The decoction of the leaves have parasiticide, antirheumatic and antineuralgic effects when used internally, while the cooked leaves, applied topically, fight rheumatism and abscesses⁴⁶⁻⁴⁷. Among the chemical constituents found in *Annona muricata*, the alkaloids (reticuline, coreximine, coclaurine and anomurine) and essential oils (β -caryophyllene, δ -cadinene, epi- α -cadinol and α -cadinol)⁴⁸ stand out. However, species of the Annonaceae family, including *Annona muricata*, have also been targeted for investigation due to appurtenant substances in the acetogenins class that have been isolated from different parts of the plant⁴⁹. For example, anomuricins A and B, gigantetrocin A, annonacin-10-one, muricatetrocins A and B, annonacin, goniotalamicin⁵⁰, muricatocins A and B, annonacin A, (2,4-*trans*)-isoannonacin, (2,4-*cis*)-isoannonacin⁵¹, anomuricin C, muricatocin C, gigantetronenin⁵², anomutacin, (2,4-*trans*)-10R-annonacin-A-one, (2,4-*cis*)-10R-annonacin-A-one⁵³, annopentocins A, B and C, *cis*- and *trans*-anomuricin-D-ones⁵⁴, anomuricine, muricapentocin⁵⁵, muricoreacin and murihexocin C⁵⁶ and annocatacin A and B⁵⁷ were identified in the leaves. These acetogenins have cytotoxic properties against tumor cell lines⁵⁰⁻⁵⁷ and molluscicidal activity⁵⁸. In addition, *Annona muricata* leaf extracts have antioxidant⁵⁹ and molluscicidal properties⁶⁰. Several studies by different researchers demonstrated that the leaf, bark, root, stem and seed extracts are antibacterial in vitro against numerous pathogens⁶¹ and that the bark has antifungal properties⁶². Much of the recent research on *Annona muricata* has been

on a novel set of phytochemicals (*Annonaceous acetogenins*) that are found in the leaves, seeds and stem which are cytotoxic against various cancer cells^{57,63}.

D). *GARCINIA KOLA*

Garcinia kola belongs to the family Guittiferae and it is commonly called "Orogbo" in Yoruba language while the English name is bitter kola. The plant has been referred to as a "wonder plant" because every part of it has been found to be of medicinal importance⁶⁴. *Garcinia kola* is used in folklore remedies for the treatment of ailments such as liver disorders, hepatitis, diarrhea, laryngitis, bronchitis and gonorrhoea⁶⁵. The seed is masticatory and also used to prevent and relieve colic, chest colds, cough and can as well be used to treat headache. Iwu⁶⁵ reported the use of this plant for the treatment of jaundice, high fever, purgative and chewing stick. The plant also found usefulness in the treatment of stomach ache and gastritis⁶⁶. The phytochemical compounds isolated from *Garcinia kola* include oleoresin⁶⁷, tannins, saponins, alkaloids, cardiac glycosides⁶⁸. Other phytochemical compounds so far isolated from *Garcinia kola* seeds are biflavonoids such as kolaflavone and 2-hydroxybi-flavonols⁶⁹. Two new chromanols, garciolic and garcinal, together with δ -tocotrienol were reported isolated from *Garcinia kola*⁷⁰. The biflavanones are predominant compounds in *Garcinia kola* and kolaflavanones are major components of kolaviron⁷¹. Flavonoids which are part of the phytochemical constituents of *Garcinia kola* exhibit a wide range of biological activities one of which is their ability to scavenge for hydroxyl radicals, and superoxide anion radicals, and thus health promoting in action⁷². Flavonoids also exhibit anti-inflammatory, antiangiogenic, anti-allergic effects, analgesic and antioxidant properties⁷³. These observations support the usefulness of *Garcinia kola* in folklore remedies for the treatment of various infections. Cardiac glycosides are important class of naturally occurring drugs whose actions helps in the treatment of congestive heart failure. This

compound has been reported to be a novel cancer therapeutic agent⁷⁴. Cardiac glycoside was present in *Garcinia kola* extract, and this plant is used for the treatment of cardiac infections along with other ailments such as cough, and chest pain among Yoruba tribe of southwestern Nigeria. Tannins exert antimicrobial activities by iron deprivation, hydrogen bonding or specific interactions with vital proteins such as enzymes in microbial cells. Herbs that have tannins as their component are astringent in nature and are used for the treatment of intestinal disorders such as diarrhea and dysentery⁷⁵. Tannins have been observed to have remarkable activity in cancer prevention⁷⁶. In addition to this, tannins, has been shown to be useful in treatment of inflamed or ulcerated tissues. Just *et al.*⁷⁷ revealed inhibitory effect of saponins on inflamed cells. Saponin present in *Garcinia kola* extract has supported the usefulness of this plant in managing inflammation. Steroidal compound also present in *Garcinia kola* extract are of importance and interest due to their relationship with such compounds as sex hormone⁷⁸. Apart from been used for folklore remedies, *Garcinia kola* seeds are also chewed by many people because of their bitter taste. These suggest that the seeds are not toxic and hence there is need for the preparation of different formulations towards ensuring acceptable dosing regimen pursuant to clinical trials.

E). *SPONDIAS MOMBIN*

Spondias mombin L. (Anacardiaceae) also known as hog plum is a plant that grows in almost every part of the world. It is fruitiferous deciduous plant of about 20m high that grows in the rain forest and the coastal area of Africa. It is known locally as "iyeye" and "iyawe" by the Yoruba and Hausa people of Nigeria⁷⁹. The trees are used for fencing and in the construction of yam storage barns. Ripped fruits are eaten out hand by the old and young and processed into ice-cream, cool beverages, wine, jam and other preservatives. *Spondias mombin* also found application in folk medicine.

Tradomedicine practitioners across Africa use all parts of the plant for medicinal purposes. The fruits decoction is drunk as a diuretic and febrifuge, while the decoction of the bark and leaves is used as an emetic, anti diarrhea, dysentery recipe and for haemorrhoids as well as for gonorrhoea and leucorrhoea⁸⁰. Infusion of its leaves has been used for a long time, without any report of collateral effect due to its anti-vitrotic activity against the herpes virus. A tea of the flowers and the leaves is taken to relieve stomach ache biliousness, urethritis, cystitis and eye and throat inflammation. Herbalist in South West Nigeria use the plant in the treatment of typhoid, tuberculosis, diabetics, nervous disorders and psychiatric disorders⁷⁸⁻⁸⁰. The extract of the fresh crushed leaves and the powder of the dried leaves are used as poultices for healing wounds, inflammation, varicose ulcers, frost-bite and burn in herbal medicine⁸¹. The gum is used as expectorant and to expel tape worm⁸². Offiah and Anyanwu,⁸³ have reported the abortifacient activity of the aqueous leaf extract of *Spondia mombin*. In addition, the anthelmintic, molluscicidal, anxiolytic, anti-bacteria, antiviral effect of the plant^{80, 84} have been previously described. Idu *et al*,⁸⁴ reported the inhibitory activity of *spondia mombin* against *Cycas revoluta* induced carcinogenesis.

F). RAUVOLFIA VOMITORIA

Rauvolfia vomitoria is a medicinal plant that is widely distributed in the humid tropical secondary and low land forests of Africa and Asia. It belongs to the family Apocynaceae and grow to a height of about 15 m. It is popularly known as "Asofeyeje" (meaning bearing fruits for the birds) among Yoruba people in Nigeria, while the Igbo people in Nigeria and Ashantes of Ghana called it Akanta and Pempe respectively. Across the coast of West Africa, it is planted as ornamental tree, shade provider for plant like cocoa, support for vanilla and for live fencing. Traditional medicinal practitioners in Nigeria and other parts of Africa use different part of the plant in treating fever, general weakness, intestinal diseases, liver problems,

mental illness, impotency, haemorrhoids, rheumatism, stomach ache, hypertension, insanity, snakebite, and cholera. Decoctions of the leaves of *Rauvolfia vomitoria* have a powerful emetic and anti-swelling effect. In addition, its tissue lipid lowering-effect, blood pressure lowering, antipyretic, analgesic, haematinic, aphrodisiac, emetic, purgative, dysenteric, abortive, insecticidal, anti-diabetic, anti psychotic, anticonvulsant properties have all been described⁸⁵⁻⁸⁶. Extract from the plant have also been reported to inhibit the growth of bacterial, viral, fungal and parasitic pathogens. Phytochemical screening of the methanolic Extract of *Rauvolfia vomitoria* plant reveals the presence of antioxidant alkaloids, saponins, phenols, terpenoids, flavonoids, cardiac glycosides, coumarines, anthraquinones and anthocyanins⁸⁵. Also, β -carboline alkaloid, alstonine found in the extract of *Rauvolfia vomitoria* has been reported to reduce tumor cell growth in mice inoculated with YC8 lymphoma cells or Ehrlich ascitic cells⁸⁷. Similarly, it was recently shown that extract of *Rauvolfia vomitoria* effectively inhibit cell growth in the human prostate cancer cell line, LNCaP, in both cell culture and in vivo tumor xenograft experimental systems by suppressing growth and cell cycle progression⁸⁶.

I). ALLIUM SATIVUM (GARLIC)

Garlic (*Allium sativum* Linn.), has been found to have an important dietary and medicinal role for centuries⁸⁸. The spice has come under extensive use due to its effect on the cardiovascular system as well as antibiotic, antidiabetic, antioxidant, immunomodulatory, antiinflammatory, hypoglycemic and hormone-like effect. Recently, it has been found that the garlic and its compound have anti-mutagenesis and anti-carcinogenesis effects. *In vivo* studies show that garlic and its associated sulfur components suppress the incidence of tumors in rodent models⁸⁹. In addition, garlic has been shown to modulate the toxicity of a number of environmental carcinogens. For instance, Shukla and Taneja,⁹⁰ reported that garlic inhibit the

clastogenicity of cyclophosphamide in Swiss albino mice. Furthermore, extract of garlic has been shown to protect the liver against acetaminophen⁹¹, ethanol, N-nitrosodiethylamine (NDEA)⁹².

CONCLUSION

Phytochemicals and antioxidants found in these plants would be useful as chemo-

preventive or chemotherapeutic agents. The inductive activity of the compounds in these plants in transformed cells when compared to in normal cells are indicative of the efficacy of the compounds as chemopreventive agents. Diets rich in phytochemicals and antioxidants present in these medicinal plants may results in a positive health effect via scavenging of free radicals and oxidative stress.

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