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Review Article

THE GLOBAL RELEVANCE OF TRADITIONAL MEDICINE AND HERBAL PLANTS, THE NIGERIAN PERSPECTIVE

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ABSTRACT : Plants have played prominent roles not only as sources of medicaments used in the treatment of diverse diseases but have also contributed immensely to the wealth of individuals and economy of many nations. Medicinal plants offer great prospects for development of novel chemotherapeutic agents and antimcrobials which are essential for proper management of various ailments in man and animals. Most plant products are cheaper because of their abundance. They are natural and generally devoid of marked adverse effects commonly experienced with xenobiotics. There have been calls in different international fora on heads of governments to support research into herbal medicines and to incorporate traditional medicine practice into modern health care delivery systems in order to combat recurrent health challenges. Documented plants have demonstrated significant potential in the handling or treatment of some notable diseases such as malaria, acquired immune deficiency syndrome (AIDs), sickle cell anaemia, diabetes mellitus, trypanosomosis, peptic ulcer, hepatitis, envenomation, bacterial infections, helminthoses, cancer to mention but a few.

Keywords: Xenobiotics, Antimicrobials, Helminthoses, Malaria, Traditional medicine

INTRODUCTION

The use of plant preparations for therapeutic medications dates back to history. *Galenical* refers to ancient (131-201 A.D.) crude medicines prepared by maceration of a large number, sometimes 30-60 herbs in alcohol or water for treating an ailment (Jones, 1962). There is a global resurgence of interest in traditional medicines due to reduced efficacy with numerous synthetic drugs occasioned by diverse adverse effects and disease resistance. Fortunately, Africa is richly endowed with medicinal plants (Puri and Thalalaji, 1964) but the continent is grossly under-explored. In the present era, most recent researches examine how traditional health practices and herbal medicines can complement modern medical systems. The World Health Organisation (WHO) Traditional Medicine Strategy 2002-2005 was launched at the 55th session of the World Health Assembly (Samber, 2003). The Organisation of African Unity (OAU), now the African Union (AU), set up the Scientific and Technical Research Commission (OAU/STRC), which organized the Inter-African symposium on the development of African medicinal plants in Dakar in 1968 (Kasilo, 2003). The symposium decided that efficacy of herbs used by traditional health practitioners should be evaluated.

The 50th session of the WHO Regional Committee for Africa held in Burkina Faso in 2002 adopted a five-point strategy on promotion of traditional medicine. The five priority interventions that member states were encouraged to implement include policy formulation, capacity building, research promotion, development of local production on traditional medicines and protection of Intellectual Property Rights (Samber, 2003).

The Alma-Ata Declaration recognised the role of traditional medicine for the achievement of 'Health for All' and recommended that proven traditional medicines and health practices should be incorporated into national essential medicine programmes for primary health care (Trapsida, 2003). A summit of the Heads of State of AU in July, 2003 endorsed the institution by WHO, of an African Traditional Medicine Day to be August 31 annually, for advocacy in member States. Most recently, the African Union (AU) declared the period 2001-2010 as the year of traditional medicine (Isoun, 2003). Traditional medicine is therefore, listed as an important strategy in the plan of NEPAD – New Partnership for Africa's Development.

In Nigeria, many organisations and Government agencies have called for a closer collaboration between traditional and modern medicine. A lot of interest and attention have been drawn to the curative claims and norms of traditional medicine. The choice of mass media channels of radio, television, news magazines and broken-down vehicles fitted with loud speakers as opposed to the traditional channel of reaching only a limited number of audiences, is a persuasive innovation to raise the level of awareness on herbal therapy (Adegoju, 2008). Prospects for medicinal plants are not only in therapeutic application. Promotion of local production of herbal medicines will create new jobs and earnings in both local and foreign currencies, with multiplier effects on the national economy, community development, family support systems, technical expertise and socio-economic status of employees. It will impact positively on poverty reduction and enhance the empowerment of women in the rural areas through acquisition of new skills (e.g. medicinal plant cultivation, harvesting and post-harvest processing, improved earning capacity, contribution to economic growth and elevated social status. Indiscriminate importation of drugs will be curtailed. A scenario as in the case of artemisinin (a very potent anti-malaria medicine) which is grown in Tanzania, harvested and then exported to Europe for processing and pharmaceutical formulation, only to be subsequently imported into the country and sold at exorbitant prices (Wambebe, 2002), will be reduced.

Traditional medicine knowledge and practice would open a vast reservoir of opportunity for research in phytopharmacology. Plants could be a source of new drugs that may offer recipe for some of the notable health challenges of today. Bacterial resistance and continuous changes in susceptibility patterns to anti-microbial agents (Carter and Cole, 1990), resistance in trypanosomes by virtue of antigenic variations (Urquhart *et al.,* 1987), threat of Avian influenza pandemic (De Jong, *et al.,* 2005, Fauci, 2006), the ravaging Human Immuno-deficiency virus (HIV) accompanied by the scourge in Acquired Immune Deficiency Syndrome Lackner and Veasey, 2007), to mention but a few, have placed burden on mankind to explore alternative approaches at combating them.

Some specific pathological conditions and herbal plant remedies

International drug development agencies are now looking at natural medicinal plants as sources of new drugs, a dimension known as 'bioprospecting' (Isoun, 2003). Today, a large section of the world's population relies on traditional remedies to treat plethora of diseases due to their low costs, easy access and reduced side effects Brander *et al.,* 1991). Many industrial drugs are derived as a result of knowledge got from folklore medicine (George, 1980). There is therefore, a renewed interest in the investigation of natural products and herbal medicine for their active ingredients (Ranaivoravo, 2003). Preliminary collated results for the evaluation of traditional medicines using protocols developed by WHO Regional office for Africa (AFRO) in the treatment of HIV/AIDS, malaria and sickle cell anaemia are reportedly very encouraging (Samber, 2003). The work of the Malagasy Institute for Applied Research (IMRA) on malaria has resulted in the discovery of a new medicine which is effective against chloroquine-resistant strain of *Plasmodium falciparum* (Trapsida, 2003).

Research by a team at the National Institute for Pharmaceutical Research and Development (NIPRD) in Abuja, Nigeria, has led to the development and standardization of two traditional medicines called *Dopravil* and *Cornavil* that are effective in the management of HIV/AIDS (Shingu, 2003). NIPRD has also standardized a traditional medicine known as *Niprisan* for the management of sickle-cell anaemia (Shingu, 2003). A World Bank-sponshored Science and Technology Education Post-Basic (STEP-B) project co-ordinated by Prof. I. U. Asuzu is in progrss at the University of Nigeria, Nsukka (Cbibuihem, 2008). The research project seeks to explore the curative potentials of plants with a view to formulating the active principles as therapeutic antidotes against malaria, diabetes mellitus and trypanosomosis.

Peptic ulcer: The disease is a chronic, non-malignant inflammatory disorder characterised by ulceration in the gastro-intestinal tract (stomach and duodenum). The pathophysiology of gastric ulceration is due to an imbalance between aggressive factors (acid, pepsin, Helicobacter *pylori* and non-steroidal anti-inflammatory agents) and local mucousal defensive factors (mucuos bicarbonate, blood flow and prostaglandins) (Greene and Harris, 1993). Peptic ulcer results from over-bearing effects of the aggressive factors. Many plants have demonstrated proven efficacy in reducing or completely inhibiting ulcerogenic activity in different ulcer-inducing models. Examples of such include *Ficus surforsk* (Moraceae), *Combretum dolichopetalum, Calligonium comosum, Rumex patientia, Syngortanthus arthrotrichus* SILVEIRA etc. (Akah *et al.,* 1998., Asuzu and Njoku, 1992., Liu *et al.,* 2001., Batista *et al.,* 2004).

Hepatitis: The pivotal role of liver in biotransformation makes it susceptible to toxic assault by xenobiotics. Liver could be damaged due to effects from medications (e.g. paracetamol), alcohol abuse, hepatotoxins, autoimmune hepatitis viral and microbial infections (Charles and Roberts, 1994., Ajith *et al.,* 2006). Damage to hepatic cells induces leakage of plasma to cause an increased level of hepatospecific enzymes in serum. The measurement of serum aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (ALP) levels serve as a means for indirect assessment of liver function (Tolman and Rej, 1999). Some plants with reported hepatoprotective properties are Garcinia kola Ker Gaul (Clausiaceae), *Tinospora cordifolia* (A. Rich.), *Ricinus cummunis Linn* (Euphorbiaceae), *Curcuma longa Linn* (Zingiberaceae), *Enicostermma littorale Blume* (Gentianaceae), *Flaveria trinervia Linn* (Asteriaceae) and *Boerhaavia diffusa Linn* (Nyctaginaceae) (Devaki *et al.,* 2004., Umadevi *et al.,* 2004., Vishwakarma and Goyal, 2004).

Diabetes mellitus is a major cause of severe health complications and premature deaths in many developing countries. The disease is a metabolic disorder of multiple aetiology characterised by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting in defects in insulin secretion, insulin action or both (WHO, 1985). The characteristic symptoms include thirst, polyuria, blurred vision and weight loss but in severe forms, ketoacidosis or a non-ketotic hyperosmolar state may develop and lead to stupor, coma and, in absence of effective treatment, death (Alberti and Zimmet, 1998). The long-term effects of diabetes mellitus include progressive development of the specific complications of retinopathy with potential blindness, nephropathy that may lead to renal failure, and/or neuropathy with risk of foot ulcers, amputation, charcot joints, and features of autonomic dysfunction, including sexual dysfunction. People with diabetes are at increased risk of cardiovascular, peripheral vascular and cerebro-vascular diseases. The diagnostic fasting plasma (blood) glucose value is lowered to $\geq$ 7.0 $mmol^{-1}$ (6.1$mmol^{-1}$). Impaired Glucose Tolerance (IGT) was modified to Impaired Fasting Glycaemia (IFG) to encompass values which are above normal but below the diagnostic limits for diabetes (plasma $\geq$ 6.1 to < 7.0 $mmol^{-1}$; whole blood $\geq$ 5.6 to <6.1 $mmol^{-1}$). Diabetes is classified as Type 1, autoimmune and non-autoimmune, with beta-cell destruction; Type 2 with varying degrees of insulin resistance and insulin hyposecretion; Gestational diabetes mellitus; and other types where the cause is known (e.g. endocrinopathies) (National Diabetes Data Group, 1979).

The major change in the diagnostic criteria for diabetes mellitus from the previous WHO recommendation (WHO, 1985) is the lowering of the diagnostic value of the fasting plasma glucose concentration to 7.0 $mmol^{-1}$ (126 mg/dl) and above, from the former level of 7.8 $mmol^{-1}$ (140 mg/dl) and above. For whole blood, the proposed new level is 6.1 $mmol^{-1}$ (110 mg/dl) and above, from the former 6.7 $mmol^{-1}$ (120 mg/dl) (WHO, 1985). Many plants were documented to be effective for treating diabetes in folklore medicine and their hypoglycemic activities were scientifically evaluated. Some of such plants are *Oryza sativa* (Hikino *et al.,* 1986), *Ephedra distachya* L (Konno *et al.,* 1985), *Artemisia herba-albai* (Al-Waili, 1986), *Tecoma stans Juss* (Perez *et al.,* 1984).

Malaria is a significant public health problem in more than 90 countries inhabited by about 40% of the world's population (Rang *et al.,* 2003). Malaria causes up to 2.7 million deaths per year with the vast majority of these among young children in Africa, especially in remote rural areas with no access to medical care (Rang *et al.,* 2003). The disease is caused by plasmodium species and usually transmitted by female Anopheles mosquitoes. *Plasmodium falciparium* is the most dangerous of all the species. The pre-erythrocytic stage of the infection is associated with rapid development and multiplication of the parasites leading to rupture of numerous parasitized hepatocytes. In the erythrocytic stage in which the plasmodia invade the host red blood cells, the parasite remodels the host cells, inserting parasite proteins and phospholipids into the red cell membrane. The host's haemoglobin is digested and transported to the parasite's food vacuole, where it provides a source of amino acids. Free haem which would be toxic to the plasmodium, is rendered harmless by polymerization to haemozoin. The rapid growth and multiplication (schizogony) in red blood cells resulting in the production of merozoites cause erythrocytes to rupture. Malaria parasites can multiply in the body at a phenomenal rate-a single parasite of plasmodium vivax being capable of giving rise to 250 million merozoites in 14 days (Ritter *et al.,* 1995). The clinical signs suggestive of malaria are fever, headache, backache, shivering and fatigue, repeated vomiting, generalized convulsions and coma. In the context of traditional practice, malaria was treated with decoctions and infusions from many plants. Today, plants are used as sources of novel antimalarial compounds. Extracts from the root of the plant, *Cryptolepis sanguinolenta* known as *Nimiba* in *Twi,* Ghana was used by herbalists to treat malaria before the introduction of orthodox medicine (Yakubu, 2010). Quinine, a potent antimalarial drug was isolated from *Chinchona officinalis* and *Chinchona pubescens* bark (DiPALMA, 1971). The quinoline alkaloid, gamma-fagarine exhibited the strongest antiplasmodial activity among five alkaloid isolates from the stem bark of *Zanthroxylum tsihanimposa,* a popular plant in Madagascar (Randrianarivelojosia *et al.,* 2003). Artemisinin was isolated in 1972 from *Artemisia annua,* a plant indigenous to temperate Asia but now naturalized throughout the world (Wikipedia, the free encyclopedia). It is used in combination therapy with other antimalarials to prevent development of parasite resistance.

Antimicrobial drugs. Bacteria consist of heterogenous groups of micro-organisms. Bacteria are classified as Gram-positive or Gram-negative based on the staining ability with Gram's stain. The morphological differences between the two classes determine their antigenicity and susceptibility to antibiotics. Among the Gram-positive cocci are *Staphylococcus, Streptococcus, Enterococcus and Pneumococcus*. Gram-negative cocci include *Morasella catarrhalis*, *Neisseria gonorrhoeae* and *Neisseria meningitis* (Brooks *et al.,* 2004). Gram-positive rods are *Corynebacterium, Clostridium,* and *Listeria* while Gram-negative rods consist of *Eschericha coli, Shigella, Salmonella, Haemphilus, Bordetella, Pasteurella, Vibrio, Legionella pneumophila, Helicobacter, Pseudomonas, Brucella,* and *Campylobacter.* Other microbes include Spirochaets (*Treponema, Borrelia, Leptospira*), *Mycoplasma, Chlamydia, Actinomyces* and *Nocardia* (Radostits *et al.,* 1994) . Many of the antimicrobial drugs currently used to treat bacterial and fungal infections were originally developed from natural sources such as plants, minerals and animal. Roopashree *et al.* (2008) reported the antibacterial activity of *Cassia tora, Momordica charantia* and *Calendula officinalis.*

Fractions of extracts from *Albizia amara* leaves exhibited antimicrobial activities particularly against *Escherichia coli, Salmonella typhi, Klebsiella pneumonia Bacillus cereus, Staphylococcus aureus,* and fungi (*Candida albicans* and *Cryptococcus neoformans*) (Runyoro *et al.,* 2006., Woongchon *et al.,* 1991). The extract of the plants from Camellia sinensis (leaves), Delonix regia (flowers), Holarrhena antidysenterica (bark), Lawsonia inermis (leaves), Punica granatum (rind), Terminalia chebula (fruits) and Terminalia belerica (fruits) showed a broad-spectrum of antibacterial activity with an inhibition zone size of 11 mm to 27 mm, against all the test bacteria (Aqil *et al.,* 2007). Aqil *et al*. further reported that the extracts from the leaves of Ocimum sanctum showed better activity against three beta-lactamase producing methicillin-resistant Staphylococcus aureus (MRSA) strains. In search of broad-spectrum antibacterial activity, 66 ethanolic plant extracts were screened against nine different bacteria and 39 extracts demonstrated activity against six or more test bacteria. Twelve extracts showing broad-spectrum activity were tested against specific multidrug-resistant (MDR) bacteria, methicillin-resistant Staphylococcus aureus (MRSA) and extended spectrum beta-lactamases (ESbetaL)-producing enteric bacteria. In vitro efficacy was expressed in terms of minimum inhibitory concentration (MIC) values of plant extracts. MIC values ranged from 0.32-7.5 mg/ml against MRSA and 0.31-6.25 mg/ml against ESbetaL-producing enteric bacteria. The overall activity against all groups of bacteria was found in order of Plumbago zeylanica > Hemidesmus indicus > Acorus calamus > Camellia sinensis > Terminalia chebula > Terminalia bellerica > Holarrhena antidysenterica > Lawsonia inermis > Mangifera indica > Punica granatum > Cichorium intybus and Delonix regia.

Snakebites cause significant deaths in human and animal species. Many snake venoms contain combinations of neurotoxins, haemolysins, coagulants and cytotoxins in various proportions (Stone, 1979). Conventional antivenoms currently available are not only expensive but do not effectively neutralize venom induced haemorrhage, myonecrosis and nephrotoxicity (Ferreira *et al.,* 1992). Plants reportedly possessed antivenom activities and were found useful in the treatment of diverse cases of envenomation. Some of the plants include *Parkia biglobosa* (Mimosaceae), *Crinum jagus bulb* (Amaryllidaceae), and *Schumanniophyton manificum* (Akunyili and Akubue, 1987., Asuzu and Harvey, 2003., Ode and Asuzu, 2006) . Owuor and Kisangau (2006) compiled over 30 kenyan medicinal plants used as antivenin.

Lipid peroxidation and reactive oxygen species: Recent evidence indicates that some saturated and unsaturated aldehydes, including malondialdehyde (MDA), hydroxyalehydes and other short chain carbonyl compounds contribute to peroxidative cell damage by reacting with sensitive biomolecules[57]. Reactive oxygen species are oxygen-centered molecules which include the non-radicals, hydrogen peroxide (H_2O_2), hypochlorous acid (HOCl), hydroxyl anion (HO) and single Oxygen (O_2); and the radicals, superoxide anion (O_2^-), hydroxyl radical (HO^-), and nitric oxide (NO^-) (Al-Omar *et al.,* 2004). Potentially harmful reactive oxygen species are produced as a consequence of normal aerobic metabolism. Phagocytes such as neutrophils and macrophages produce reactive oxygen species (ROS) during phagocytosis (Foreman and Torres, 2002). Chemicals and pollutants in food, drugs, alcohol and exposure to natural radiation, pesticides, and air pollutants contribute to generation of free radicals in our body. Many physiological and pathological conditions such as ageing, inflammation, viral infections, and neurodegerative diseases may develop through the action of reactive oxygen species (Al-Omar *et al.,* 2004). ROS can induce damage to endothelial, glomerular mesangial and tubular epithelial cells and can induce apoptosis in renal cells (Hosseindzadeh *et al.,* 2005). Oxidative stress-induced tissue damage with ROS is implicated as a cause and consequence of a variety of disorders, including coronary heart disease and cancer (Knight and McCafferty, 1996).

Antioxidants consist of vitamins, polyphenols, flavonoids (Réka and Varga, 2002), minerals and endogenous enzymes such as superoxide dismutase, catalase and glutathione peroxidase that have the capability to neutralize unstable molecules called free radicals. Vitamin A (retinol), vitamin C (ascorbic acid), vitamin E (tocopherol) and selenium are valuable antioxidants.

Hence, a balanced diet rich in whole grain cereals, nuts, seeds, fruits and vegetables provides essential vitamins, minerals, antioxidants and other nutrients that are relevant in the prevention of diverse pathologies (Okubena, 2010). Antioxidants are among the first link between chemical reactions and biological activity (Trouillas *et al.,* 2003). Antioxidants do not completely get rid of free radicals in the body but they retard or minimize the damage caused. Antioxidants block the process of oxidation by neutralizing free radicals and by this action, they themselves become oxidized. The body is therefore in need of a steady source of antioxidants. Antioxidants disrupt the chain reaction in which free radicals turn other molecules into free radicals like themselves, a process of chain-breaking or stabilization.`

Cancer or neoplasm is a disease in which there is uncontrolled multiplication and spread within the body of abnormal forms of the body's cells. Cancer may be benign or malignant depending on the ability of dediffentiation and loss of function, uncontrolled proliferation, invasiveness and the tendency to metastasise. Cancer is one of the major causes of death, at least one in five of the population of Europe and North America can expect to die of cancer (Rang *et al.,* 2003), breast cancer is a leading cause of death among African women. Genetic mutations, hormonal effects, radiations, viruses and effects of chemicals are some of the predisposing factors to oncogenesis. Treatments may involve surgical excision, irradiation or chemotherapy. The vinca alkaloids (vincristine, vinblastine, vindesine and vinorelbine) are plant derivatives that offer tremendous recipe in cancer treatment (Rang *et al.,* 2003). They act by binding to tubulin and inhibiting its polymerization into microtubules, which prevents spindle formation in mitosing cells and causes arrest at metaphase. Their effects only become manifest during mitosis in cancer cells. Flavonoids present in many plants are valuable in cancer prevention. The molecular mechanisms of the anticarcinogenic effects of flavonoids include their antagonistic effect on the aryl hydrocarbon receptor (AhR), and regulation of phase I and II drug metabolizing enzymes and phase III transporters (Nishiumi *et al.,* 2011). Experimental evidence suggests that flavonoids modulate signal transduction pathways at each stage of carcinogenesis. Isolated dietary components such as lycopene, resveratrol, and isothiocyanate compounds have been shown to provide limited protection against cancer development, Zyflamend contains ingredients that can suppress tumor cell proliferation, invasion, angiogenesis, and metastasis through regulation of inflammatory pathway products. Zyflamend inhibits melanoma growth by regulating the autophagy-apoptosis switch (Ekmekcioglu *et al.,* 2005). Isolates (podophyllotoxone (PTO) and 4'-demethyldeoxypodophyllotoxin) from the roots of Dysosma versipellis, a traditional Chinese medicinal herb had potent inhibitory activities against the growth of human carcinoma cell lines (Xu *et al.,* 2011).

Anthelmintic activities: Worm infections involving cestodes (tapeworms), trematodes (liver flukes), nematodes (roundworms), tissue roundworms (e.g. *Trichinella spiralis,* filariae) are major causes of ill health in both man and animals. Helminths induce different pathologies in their hosts. Filarial diseases are caused by *Wuchereria* or *Brugia*, which cause obstruction of lymphatic vessels producing elephantiasis, microfilaria causes onchocerciasis (river blindness), cutaneous larva migrans is caused by the larva of cat and dog hookworms, toxocariasis (visceral larva migrans) is caused by the larva of cat and dog roundworms in humans (Urquhart *et al.,* 2003). Some nematodes produce severe anaemia, intestinal ulcerations with resultant poor growth of the host. Plants provide good sources of anthelmintic agents. Alcoholic extracts of the rhizomes of *Alpinia galanga, Andrographis paniculata*, bark of *Cinnamomum zeylanicum*, rind of *Citrus decumana, Desmodium triflorum*, seeds of *Hydnocarpus wightiana*, rhizomes of *Kaempfaria galanga, Lippia nodiflora*, tender leaves of *Morinda citrifolia*, rhizomes of *Pollia serzogonian, Tephrosia purpuria* and rhizomes of *Zingiber zerumbeth* showed good in vitro anthelmintic activity against human Ascaris lumbricoides (Raj, 2005).

Preparations from *Carica papaya, Sapindus trifoliatus, Butea frondosa and Momordica charantia* were more effective than piperazine hexahydrate Lal *et al.,* 1976). The root tuber extract of *Flemingia vestita*, an indigenous plant consumed by the natives in Northeast India, showed vermifugal activity against live helminth parasites (nematode: Ascaris suum from pigs, A. lumbricoides from humans, Ascaridia galli and Heterakis gallinarum from domestic fowl; cestode: Raillietina echinobothrida from domestic fowl; trematode: Paramphistomum sp. from cattle) (Tandon *et al.,* 2003). Fractions of *Spigelia anthelmia* Linn extracts showed deparasitization activities against *Nippostrongylus braziliensis* in rats (Jegede *et al.,* 2009).

Conclusion

Plants and their active constituents have proved valuable in the treatment of a wide spectrum of health challenges, yet prospects for discovery of noble chemotherapeutic agents from plant sources abound. The contributions of phytomedicaments to the overall health of man and animal species cannot be over-emphasised. This explains why herbal medication appears to be more appreciated and preferred to orthodox (modern) medicine in many parts of Nigeria for handling mental derangements. People have attested to the healing potentials of herbal plants in diverse pathological conditions.

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