



Sustainable exploitation of African medicinal plants

Egharevba H.O.*, Ibrahim J.A., Kunle O.F., Gamaniel K.S.

National Institute for Pharmaceutical Research and Development (NIPRD) Abuja, Nigeria.

Received for publication: October 23, 2015; Accepted: November 13, 2015

Abstract: Medicinal plants have been used for food, shelter, clothing and medicine for survival by humans since ancient times. However, over the last few decades, there appears to be renewed increase in demand for medicinal plant resource following WHO support for herbal medicine development, increase awareness of its social and economic significance, research validation of herbal remedies efficacy claims, etc. This renewed exploitation has led to depletion and endangerment of some species, and therefore unsustainable. This article discussed the current trend in the utilization of medicinal plants and highlights the challenges of unsustainable exploitation of medicinal plants. It also suggested solutions and way forward towards achieving a more sustainable use of medicinal plant resources as way of supporting the sustainable development goals.

Key words: Sustainable exploitation; African Medicinal Plants; Food as medicine

INTRODUCTION

Traditionally the basic necessities of man have been food, shelter and clothing. Men have always survived on food for its wellbeing and rely on shelter and clothing for warmth and safety. Since ancient times till date in most part of the world, and especially in the developing world, humans have relied largely on plant resources in meeting these basic needs (Sofowora, 2008). Humans realizing the great resource potential provided by nature in medicinal and aromatic plants for a healthy life have depended on the diversity of these plant resources for food and medicine to cure myriads of ailments. Led by instinct, taste, and experience, primitive men and women treated illness by using plants, animal parts, and minerals, some of which were not part of their usual diet (Kunle *et al.*, 2012). Thus for a long period, the use of plant for therapeutic purpose was the basis of medical practice in ancient Asia, Africa and Europe. Most of these plants were edible and served as staple foods in the communities. Also, timber and cotton from plants resource had been used for construction and production of different infrastructural and clothing need and desires up to modern civilization. In fact, plant resources are continuously being exploited and depleted in various forms such as in foods production, technology development, research, medicine, etc. Medicinal plants have been used as foods, nutraceuticals, herbal medicines and source of leads/hit in the development of new drugs. Though this trend in use remains unchanged, there seems to be a change in the relational quantum in the various use-scheme or areas (Egharevba *et al.*, 2015; Elujoba *et al.*, 2005). For instance, there is a renewed demand for crude herbal products following WHO ratification of the development and use in local healthcare delivery to facilitate access to healthcare for all. This is further fuelled by the seeming ease of access and affordability coupled with the general safety belief because of long periods of ancestral or folkloric use. WHO approval has also fuelled research in the field of herbal medicine development, although resources for developmental impact-driven research in the field remain a huge challenge especially in the developing world. But international partner/donor agencies and networks such as US-led UN Global Alliance for South-South

Cooperation, WHO, ANDI, regional bodies (AU, WAHO, etc.), professional associations, etc., are helping to ameliorate this problem through supports for collaborations, partnerships and technology transfer.

The practice of herbal medicine is on the rise. The WHO (1991) defines herbal medicine as finished, labeled medicinal products that contain as active ingredients aerial or underground parts of plants, or other plant materials, or combinations thereof, whether in the crude state or as plant preparations (Gamaniel, 2005). Consequently, the use of medicinal plants is on the rise. According to WHO, a medicinal plant is any plant which in one or more of its organs, contains substances that can be used for therapeutic purposes or which are precursors for the synthesis of useful drugs (Sofowora, 2008).

Since most medicinal and aromatic plants are edible and staple foods in most developing communities, the concept of “food as medicine” was recently discussed by experts as a factor for consideration in the sustainable exploitation of African medicinal plant resource (HerbFest, 2015). Most nutraceuticals on OTC sale in the USA are made from common vegetables. Most prescription drugs in the last century originated from natural sources and mainly from medicinal and aromatic plants. According to IUCN, about 50,000 – 70,000 medicinal and aromatic plants are estimated to be used world-wide, some 3,000 species are traded internationally, and about 15,000 species may be threatened to some degree world-wide (ISSC-MAP, 2007). Thus the challenges of sustainable exploitation and utilization of medicinal plant resources remains a burning issue that borders on security of plant resources, social and economic considerations and achievement of the sustainable development goals (SDGs) in the developing world. This paper discussed the implication of unsustainable plant resource use and suggested the way forward for ensuring sustainable use.

*Corresponding Author:

Henry O. Egharevba, PhD, PICCON, MCSN, MRSC.

Head, Phytochemistry

Dept. of Medicinal Plant Research and Traditional Medicine (MPR&TM)

National Institute for Pharmaceutical Research and Development (NIPRD)

Idu Industrial Layout Idu,

PMB 21 Garki, Abuja, Nigeria.

Food as Medicine

The concept of “Food” has been used within the scientific and social space in a very broad and unfocused sense with different perspectives and perceptions. On the other hand, the concept of “medicine” appears to be more fully understood as a technical term use in situations of therapeutic significance. Thus the concept of “food as medicine” could be fully understood from an understanding of the tangential of the two words, food and medicine. Generally speaking, food is an edible, portable substance (animal or plant origin) consisting of nourishing components such as carbohydrate, fats, proteins, vitamins, etc. which when ingested and assimilated through digestion sustain life, provide growth, generate energy and maintains health of the body (Business dictionary, 2015). That is, any nutritious substance that people or animals eat or drink or that is absorbed by plants in order to maintain life and growth is also considered as food. Thus foods are material consisting essentially of protein, carbohydrate, and fat used in the body of an organism to sustain growth, repair, and vital processes and to furnish energy.

On a more specific note and with particular reference to humans, food could be defined as any safe substance that could be taken orally by humans to achieve the harmony of the body, soul and spirit within a particular environment and for a particular period. Hence food usually provides energy for growth and wellbeing, satisfaction and peace. Sustainable food takes into account environmental, health, social and economic concerns. On the other hand, medicine is any substance (natural or synthetic) used with therapeutic significance and are used in treating diseases or illnesses or in maintaining and improving a state of wellbeing of users.

The concept of utilization and sustainable exploitation of resources, denote continuity, conservationism, preservation and renewable use. Thus humans could learn to balance their diet from plant resources to include various vegetable rich in active ingredients that could promote their health rather than get sick and use the herbs separately for treatments. This approach could make people to see medicinal plants as resources to be cultivated for food and health necessities, which could promote continuous availability and sustainability of plant resources (HerbFest, 2015).

Common food plants used as medicines (or medicinal plants)

The African continent is richly endowed with diverse array of plants, which are consumed by man for its nutritive and medicinal purposes. Their wide availability makes them a lifeline in areas that are resource-limited in terms of processed food and conventional medicine supplies. Some of these African well known medicinal plants include:

Bitter leaf (*Vernonia amygdalina* Del.): The leaf has been used as antidiabetic, antimalarial, antisickling, antioxidant, etc. It had been reported to contain saponins, alkaloids, sterol-terpenes, phenolic acids, etc. (Kunle and Egharevba, 2012).

Moringa (*Moringa oleifera* L.): Leaf and seed which are eaten as vegetable are rich in flavonoids, terpenoids and vitamin C, etc., and use for management of many ailment including skin and intestinal diseases.

Baobab (*Adansonia digitata* L.): The edible fruit contains 50% more calcium than spinach. It is high in antioxidants, and has three times the vitamin C of an orange. The leaves are eaten as vegetable and seed contains edible oil.

Bean (*Vigna unguiculata* L. Walp): The plant's seed is a staple food in most African communities. It is also used in antisickling recipes and found to contain saponins, reducing carbohydrate, fats and oil, steroids, glycosides, alkaloids, etc. (Kunle and Egharevba, 2013).

Okra (*Abelmoschus esculentus* L. Moench): Leaves, fruits and seeds are consumed as vegetables, and are rich in mucilage, fibre, proteins, oil, vitamins and phenolic compounds. The mucilage is use as plasma replacement for expanding blood volume, and also binds cholesterol reducing the risk of heart attacks. The seed contain oil rich in linoleic acid and polyunsaturated FAs which are also heart friendly (Gemedede *et al.*, 2014).

Pepper (*Piper guineensis* Schum. & Thonn): The plant whose fruits are commonly used as chilly spice in foods contains piperine, wisanine dihydrocubebin, guineensine, etc. It has antifungal, antimicrobial, anti-tumour, hypotension, bradycardia (slow heartbeat), immunomodulatory, antiulcerogenic, contraceptive, central nervous system depression, analgesic, antipyretic, anti-inflammatory, antioxidant and antisickling activities (Kunle and Egharevba, 2013; Okwute and Egharevba, 2013).

Bitter cola (*Garcinia kola* Heckel): The seed possess antioxidant property and is used in sickle cell disease. It had been reported to contain Kolaviron, biflavanones, tannins, etc., (Kunle and Egharevba, 2013)

Clove (*Eugenia caryophyllata* (L.) Merr. & Perry): The Fruit, leaf and stalk are used in sickle cell disease. The plant possesses antimicrobial, antioxidant, antifungal and antiviral activity anti-inflammatory, cytotoxic, insect repellent and anaesthetic properties. Essential oil rich in eugenol, eugenyl acetate, β -caryophyllene, gallotannic acid, etc., had been reported from the plant (Kunle and Egharevba, 2013).

African (white) star apple (*Chrysophyllum albidum* G.): The fruit is consumed as snack and vegetable in most African communities. The seed contains eleagnine which possesses antioxidant, anti-inflammatory and antimicrobial activity. The seed is used as antidiarrheal, etc., (Egharevba *et al.*, 2015)

Sorghum (*Sorghum bicolor* (L.) Moench): The plant is a staple food in most African communities. The leaf and seed contain alkaloids, tannins, carotenoids, cyanogenic glycosides, flavonoids, phenolic acids, etc. It has antioxidant and antisickling properties.

Cocoa (*Theobroma cacao* L.): The fruit and seed are processed into beverages and consumed. The stem bark is used as antisickling, antioxidant, etc. The plant had been found to contain saponins, polyphenolics, catechins; anthocyanins, etc., (Kunle and Egharevba, 2013)

Guayava (*Psidium guajava* Linn): The fruit is edible and widely consumed. The leaf, fruit, stem bark are used in fever, malaria, gastroenteritis, vomiting, diarrhoea, dysentery, wounds, ulcers, toothache, coughs, etc. The plant had been reported to contain saponins, tannins, flavonoids, glycosides, etc. (Egharevba *et al.*, 2010a).

Laggera (*Laggera pterodonta* (DC.) Sch. Bip.): The plant is also known as Taba-tabá (Hausa) or Taba-ebora (Yoruba). The aerial part possesses anti-inflammatory, antiviral, antibacterial, anti-tubercular and hepatoprotective properties. It contains essential oils, sesquiterpenoids and triterpenoids, etc. (Egharevba *et al.*, 2010b).

Pawpaw (*Carica papaya* L.): The fruit and leaf are edible and widely consumed as vegetables. Papaya leaves are made into tea as a treatment for malaria and help raise platelet levels in blood. Papain alkaloid had been isolated from the plant (Kunle and Egharevba, 2013).

Current trends in the use of medicinal plants

The use of medicinal plants for foods, infrastructure construction and raw materials for industries (e.g. agro, chemical, textile, pharmaceutical, etc.) seem to be on the rise with civilization, better awareness and availability of more research data. More researches are also ongoing in the areas of gene manipulation for enhanced yield and bio-production, herbal medicines, and as source of leads/hit in the development of new drugs. Though this trend in use remains basically unchanged, there seems to be a change in the relational quantum in the various use-schemes or areas in various parts of the world depending on their level of civilization. However, the current trend tends to serve some useful purposes such as:

Awareness: The public awareness of the health and economic potential of medicinal plants is on the rise and in some countries and communities people are already taking advantage of the opportunities.

Economic Gains: Due to awareness and increase demand for herbal products or resources, more people are going into preservation and conservation practices for some economic crops and plants used in medicine e.g. bitter leaf plantations, guayava plantation, cashew plantations, etc.

Research: More researches are now focused on the development of medicinal plants as an economic commodity leading to standardization, safety and proof of efficacy, product stability and preservation, better storage, handling and practices (GLP, GMP, GAP). Researches are also ongoing in many laboratories for converting wild species into cultivated ones for propagation.

Health care delivery: The scientific proof of efficacy of some of these plants has helped in widespread

acceptance even among the learned, and enabled some herbal products to be included in essential drug list in some countries to support their healthcare delivery. It has also supported the prospect and global push for better integration of herbal medicine into the healthcare delivery system of many countries.

Challenges of utilization

The major challenge of increased utilization of medicinal plant is uncontrolled exploitation and depletion of species especially endangered species leading to unsustainable practices and outcomes. This challenge comes as a result of the following:

- Poverty – synonymous with use of forest resources for energy, food and shelter, etc.
- Unregulated mode of use/practice (absence of protocols and SOPs)
- Level of education of practitioners
- Cultural beliefs and unsustainable land use policy
- Species displacement in cultivation or farming
- Indiscriminate collection, bad harvest and agricultural practice
- Lack of standardization, which could have helped in determining the direction and quantum of use through monitoring and documentation.
- Environmental factors (fire, anthropologic activities, etc.)
- Inadequate or lack of plan and action for conservation and preservation.
- Absence of large-scale cultivation and lack of strategic plan to meet future demands
- Inadequate R&D information needed to erase or modify perception, improve standardization, documentation, good agricultural practice (GAP), good manufacturing practice (GMP), and eradicate bad or unsustainable practices.

Sustainable exploitation/utilization (why sustainable exploitation)

According to IUCN (1993) and Gamaniel (2005), the use of a species is likely to be sustainable if:

- It is compatible with maintaining the ecosystem in which the species is found,
- It does not reduce the future use potential and impair the long term viability of the species,
- It does not reduce its future usefulness to humans, and
- Wherever possible, cultivation of the medicinal plants serves as the source of meeting supply,
- Collecting from the wild is controlled in a sustainable manner, and
- There are strategies and actions to improve techniques for harvesting, storage and production.

Thus the answer to the question towards solving the problems of maintaining the ecosystem, meeting future demands, ensuring adequate availability and access to medicinal plants, etc., lies with sustainable practices in biodiversity conservation and propagation such as GAP, GLP, GCP and GMP, as well as the perception that the

commodity is worthy of attracting national economic and social security attention. Further sustainable practices could be obtained by:

- Mass education and publicity of sustainable practices
- Avoiding excess commercialization which can lead to extinction of some useful and important medicinal plants.
- Discouraging unfriendly environmental practices and habitat destruction such as bush burning and deforestation without afforestation.
- Criminalizing or establishing rules and regulation against man-made destruction of medicinal plants habitats, like dumping refuse, toxic waste and toxic chemical in the habitat.
- Creating permits for exploitation of forest reserves and use of some endangered species.
- Ensuring that there is establishment of botanical gardens and medicinal plants gardens,
- Lowering cost of cultivation and processing for farmers and sector investors, and
- Creating incentives for cultivation, investments and good practices.

CONCLUSION

The United Nations (UN) recent proclamation of Sustainable Development Goals (SDGs) in rapping up the MDGs is a pointer to the fact that resource sustainability is the way to go especially for developing countries if the goals of poverty reduction and access to healthcare are to be achieved. Medicinal plants remain one of the most abundant resource of Africa and the developing world and it is fast eroding due to its unsustainable exploitation/use as industrial raw material and for food. Therefore, sustainable utilization and exploitation of plant resources and biodiversity must be advocated and practiced.

ACKNOWLEDGMENT

This article was extracted from a paper titles “Food as Medicine: Utilization and sustainable exploitation of medicinal plants. The role of NIPRD”, presented by the Director General/CEO NIPRD at HerbFest 2015, Abuja Nigeria.

REFERENCES

1. Egharevba H.O., J.A. Ibrahim, G.A. Nduaguba and O.F. Kunle. “Phytochemical, Proximate Pharmacognostic Analyses and Thin Layer Chromatography of *Chrysophyllum albidum* Seed”. *Ewemen Journal of Herbal Chemistry and Pharmacology Research* 1.1 (2015) :6-12. Online.
2. Egharevba H.O., I. Iliya, N. Ibekwe, M.S. Abdullahi, S.K. Okwute and J.I. Okogun. “Broad Spectrum Antimicrobial

Activity of *Psidium guajava* Linn”. *Leaf: Nature and Science* 8.12 (2010a): 43-50. Online.

3. Egharevba, H.O., P. Oladosu, S.E. Okhale, I. Iliya, O.F. Kunle, S.K. Okwute and J.I. Okogun. “Preliminary Anti-Tuberculosis Screening of Two Nigerian *Laggera* Species (*Laggera pterodonta* and *Laggera aurita*)”. *Journal of Medicinal Plant Research* 4.12 (2010b): 1235-1237. Online.
4. Gamaniel K.S. “Ownership and Sustainability Issues of Botanical Medicines”. *Ethnobotany Research & Applications* 3 (2005):017-023. Online
5. Gemedede H.F., N. Ratta, G.D. Haki, A.Z. Woldegiorgis and F. Beyene. “Nutritional Quality and Health Benefits of Okra (*Abelmoschus esculentus*): A Review”. *Global Journal of Medical Research* (K) 14.5:1 (2014): 28-37. Online.
6. HerbFest 2015. “Food as Medicine: Utilization and sustainable exploitation of medicinal plant. The role of NIPRD”. Workshop paper presented by the Director General/CEO NIPRD at HerbFest 2015, Abuja Nigeria. Print.
7. ISSC-MAP 2007. www.floraweb.de/map-pro. Britta Pätzold, Susanne Honnef (WWF Germany and TRAFFIC, Johann-Wolfgang-Goethe University Frankfurt). Online.
8. IUCN. “Guidelines on the Conservation of Medicinal Plants”. The International Union for Conservation of Nature and Natural Resources (IUCN), Gland, Switzerland, in partnership with The World Health Organization (WHO), Geneva, Switzerland, and WWF – World Wide Fund for Nature, Gland, Switzerland, (1993): 38p.
9. Kunle O.F. and H.O. Egharevba. “Chemical Constituents and Biological Activity of Medicinal Plants used for the Management of Sickle Cell Disease - A Review”. *Journal of Medicinal Plant Research*, 7.48 (2013): 3452-3476. Online.
10. Kunle Oluyemisi Folashade, Henry Omoregie Egharevba, Peter Ahmadu. “Standardization of Herbal Medicines”. *International Journal of Biodiversity and Conservation* 4.3 (2012): 101-112. Online
11. Okwute Simon Koma and Henry Omoregie Egharevba. “Piperine-Type Amides: Review of the Chemical and Biological Characteristics”. *International Journal of Chemistry* 5.3 (2013): 99-122. [Print/Online](#).
12. Sofowora Abraham. (2008). “Medicinal plants and traditional medicine in Africa”. Spectrum Books Limited, Ibadan, Nigeria. (2008): 7-8. Print.

CITE THIS ARTICLE AS:

Egharevba H.O., Ibrahim J.A. Kunle O.F., Gamaniel K.S. Sustainable exploitation of African Medicinal Plants. *International Journal of Bioassays* 4.12 (2015): 4636-4639.

Source of support: Nil

Conflict of interest: None Declared