AN APPRAISAL OF PHYTOMEDICINE IN AFRICA

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ABSTRACT

Medicinal plants have played a key role in the world health care with about 80% of Africans depending on phytomedicine, which has shown a wide range of uses in the treatment of diseases especially priority diseases of Africa such as HIV/AIDS, malaria, sickle-cell anemia, diabetes and hypertension. These medicinal plants have more beneficial effect than their synthetic counterparts through being safer, acceptable, affordable, culturally compatible and suitable for chronic treatments. Some African phytomedicines are well known in the international market and so supply economic benefit for the producing countries. The use of phytomedicine should be integrated into the health agenda since effective health care cannot be achieved in Africa by using orthodox medicine alone. This can be achieved by adopting the WHO memorandum and guidelines for the institutionalization of phytomedicine into the health sector. Although there are some problems limiting the development of phytomedicine, such as lack of standardization, efficacy and quality control of plants used, extinction of some plant species, lack of funds and others, if these problems can be fully addressed, this will help in the future development and harmonization of phytomedicines.

KEYWORDS: phytomedicine, traditional medicine, traditional medical practitioners (TMPs), orthodox medicine, health care system

1. INTRODUCTION

Traditional medicine as a major African socio-cultural heritage has been in existence for hundreds of years. It was once believed to be primitive and wrongly challenged by foreign religions dating back during the colonial rule in Africa and subsequently by the conventional or orthodox medical practitioners. The traditional medicine has been the focus for wider coverage of primary health care delivery in Africa and the rest of the world [1]. WHO [2] defined traditional medicine as the sum total of knowledge or practices whether explicable or inexplicable used in diagnosing, preventing or eliminating a physical, mental or social disease, which may rely exclusively on past experience or observation handed down from generation to generation, verbally or in writing. It comprises therapeutic practices in existence for hundreds of years before the development of modern scientific medicine and is still in use today without much documented evidence of adverse effects. The new health agenda in Nigeria and Africa focuses on the institutionalization of traditional medicine in parallel with orthodox medicine into the national health care scheme in order to move the health agenda forward since effective health cannot be achieved in Africa by orthodox medicine alone unless it has been complemented with traditional medicine as recorded by Elujoba *et al.* [1]. This traditional medicine comprised the use of plant, animal or mineral materials for healing [2] but the focus here is on phytomedicine (plant medicine) type. According to the World Health Organization [3], phytomedicine is defined as herbal preparations produced by subjecting

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plant materials to extraction, fractionation, purification, concentration or other physical or biological processes. These preparations may be produced for immediate consumption or as the basis for other herbal products. Such plant products may contain recipient or inert ingredients, in addition to the active ingredients.

Furthermore, Iwu *et al.* [4] reported that the first generations of plant medicine were simple botanical materials employed in more or less crude form. These medicines such as *Cinchona*, *Opium*, *Belladonna* and *Aloe* were selected based on empirical evidence as gathered by traditional practitioners. The second-generation phytopharmaceutical agents were pure molecules whose compounds differ from the synthetic therapeutic agent only in their origin, for example taxol from *Taxus spp.*, quinine from *Cinchona* and reserpine from *Rauvolfia* spp. [4]. In the development of third generation of plant medicine, the formulation is based on well-controlled double-blind clinical and toxicological studies with phytomedicine to improve the quality, efficacy, stability and the safety of the preparations [5-6].

Iwu *et al.* [4] reported that infectious diseases account for one-half of all deaths in the tropical countries. Irrespective of the efforts made in curbing the incidence of epidermics, drug-resistant microorganisms and the emergence of hitherto unknown disease-causing microbes pose enormous public health concern.

Phytomedicine has played a key role in world health care [7] with about 80% of Africans depending on it (Table 1). Phytomedicine has demonstrated its contribution to the reduction of excessive mortality, morbidity and disability due to diseases such as HIV/AIDS, malaria, tuberculosis, sickle-cell anemia, diabetes, mental disorders [1] and microbial infections [4, 8]. It has reduced poverty by increasing the economic well-being of communities and develops health system by increasing health coverage to the people [1]. Phytomedicines are now very popular in developing countries with knowledge about the safety, efficacy and quality assurance of botanical medicine as reported by Calixto [7].

Table 1 African medicinal plants with their medicinal values

Plants	Disease cured	Action	Usage	Source
Xylopia aethiopica	intestinal spasms, cough, post partum tonic, for lactation, stomach remedy, bronchitis, biliousness, dysentery, headache, female hygiene	soothing, antispasmodic, remove biliousness, emollient, sedative	poultice of the plant	[9]
Garcinia kola	bronchitis, throat infections, relieve colic, head or chest cold, cough, liver disorder	antibiotic, antispasmodic, soothing, sedative, ease cough, expectorant, choleretic	eating the seed of the plant	[10]
Vitex doniana	gastroenteritis, diarrhea, dysentery, infertility, eye diseases	antimicrobial, invigorating and anti-inflammatory	stem bark decoction	[11]
Crytolepis sanguinolenta	fever, malaria, urinary and upper respiratory tract infection, rheumatism, venereal diseases	antiplasmodial, antiviral, antispasmodic, expectorant, anti-inflammatory	hot poultice of dried root	[12-14]

Table 1 African medicinal plants with their medicinal values (cont.)

Plants	Disease cured	Action	Usage	Source
Euphorbia hirta	bronchial and respiratory disorders, urinary disorder, skin diseases, ocular diseases and dysentery	soothing antispasmodic, regenerates skin, emollient antiparasite, anti-inflammatory, antimitotic, antiviral, antibiotic, diuretic	aqueous decoctions of the plant, latex of the plant for cuts and warts	[15-16]
Ocimum gratissimum	respiratory infections, diarrhea, headache, ophthalmic (ocular) diseases, skin diseases, pneumonia, cough, fever, conjunctivitis	anti-inflammatory, soothing, expectorant, invigorating, antiseptic, sedative, emollient	aqueous and ethanol extracts of the leaves	[17]
Citrus aurantifolia	nervousness, anxiety, insomnia, gastroenteritis	sedative, mildly narcotic anti-inflammatory	infusion of leaves and flowers (orange blossom) ethanol and aqueous leaf extracts	[18-19]
Cajanus cajan	sickle-cell anemia	anti-anemic because of phenylalanine	seed	[1]

Table 2 Phytotherapeutic sales in world market [7, 20-22]

	Europe						America	Asia
Year	Germany	France	Italy	UK	Spain	Netherlands	USA	India
1995								$400 million
1996							$3.2 billion	
1997	$3.5 billion	$1.8 million	$700 million	$400 million	$300 million	$100 million		
1998	-	-	-	-	-	-	-	-
1999							$5 billion	

Table 3 Some African phytomedicinals in world market

Plant species	Action	Constituents	Countries	Source
Ancistrocladus abbreviatus	Anti-HIV	Michellamine B	Cameroon and Ghana	[23-24]
Corynanthe pachyceras	Male stimulant	Corynanthidine, corynanthine, yohimbine.	Ghana	[23]
Tamarindus indica	Insecticides	Pectins	Egypt	[25]
Rauvolfia vomitoria	Tranquilizer and antihypertensive	Reserpine, yohimbine	Nigeria, Zaire, Rwanda, Mozambique,	[23]
Cinchona succirubra	Anti malarial	Quinine	West African countries	[26]
Syzigium aromaticum	Dental remedy	Eugenol, terpenoids	East Africa countries, Madagascar	[1]
Agava sisalana	Corticosteroids and oral contraceptives	Hecogenin	Tanzania	[1]
Physostigma venenosum	Opthalmia	Physostigimine (eserine)	Calabar (Nigeria), Ghana,Cote D'ivoire	[23]
Prunus africana	Prostate gland hypertrophy	Sterols, triterpenes, n-docosanol	Cameroon, Kenya, Madagascar	[23, 27]
Catharanthus roseus	Anti-Leukemia and Hodgkin's disease	Triterpenoids, tannins and alkaloids	Madagascar	[1, 28]
Zingiber officinale (Ginger)	Spice, carminative and medicinal products	Gingerol	Nigeria	[23]
Chrysanthemum cinerariifolium	Insecticides	Pyrethrins	Ghana, Kenya, Rwanda, Tanzania, South Africa	[29]

2. BENEFITS OF PHYTOMEDICINE

2.1 Characteristics of phytomedicine

Phytomedicine has some characteristics that make them unique and different from synthetic drugs [7].

- The active principle is frequently unknown.
- The availability and quality control are frequently problematic.
- Standardization, stability and quality control are feasible but not easy.
- They have a wide range of therapeutic use and are suitable for chronic treatments.
- Well-controlled double blind clinical and toxicological studies to prove their efficacy and safety are rare when compared with synthetic drugs but well-controlled randomized clinical trial revealed they do exist.
- They are cheaper than synthetic drugs.

2.2 Why the demand for phytomedicine

For years, public interest has increased for natural therapies (mainly phytomedicine) all over the world including Africa [20-22]. According to [7, 22], there are several factors that lead to the preference and growth of phytotherapeutic market worldwide and they include

- Preference of consumers for natural therapies
- Great interest in alternative medicine
- The belief that phytomedicine is devoid of side effect since millions of people all over the world have been using phytomedicine for thousands of years
- The belief that phytomedicine is used for the treatment of certain diseases where conventional medicine fails
- Improvement in the quality, proof of efficacy and safety of phytomedicine and
- High cost of synthetic drugs.

2.3 Therapeutic Benefit of Phytomedicine over synthetic drugs

Although synthetic or chemical drugs can have greater or quicker effects than do equivalent phytomedicines, they present a higher degree of side effects and risks. For instance, psycho-pharmacological products with sedative and axiolytic action are likely to be accompanied by undesirable side effects like uncoordinated motor skills and drowsiness, but phytomedicine acts on the body by regulating and balancing its vital processes rather than stopping or combating certain symptoms. Its balancing effect on the CNS prevents disorders and unbalanced mental condition [18]. Phytomedicines are of great benefit for the respiratory system since their action are not limited to neutralizing the symptoms of any disease but they exert a true cleansing action for excessive mucus in the interior of the airway. They contain certain antibiotic substances that prevent bacteria growth in the mucus, for example *Thymus vulgaris* (thyme), *Allium sativum* (garlic) [18]. Phytomedicine have a wide range of therapeutic uses shown in Table 1 and are suitable for chronic treatments [7]. They are said to be gentle, effective and often specific in function to organs or systems of the body [4]. Plants like *Cimicifuga racemosa* (black cohosh), *Angelica sinensis* (Dong quai) and *Agnus castus* (chaste tree berry) have been reported to be specifically useful for premenstrual syndrome, PMS (excessive estrogen) as recorded by Schellenburg [30] and Wuttke [31]. Phytomedicines are good dietary supplements, which are nutritive and replenish the body. For example, sunflower seed (*Helianthus annuus)* provides vitamin B6 (Pyridoxine) as reported by MacDougall [32]. Phytomedicines are effective in treating infectious diseases as well as limit side effects associated with synthetic antimicrobial drugs [4]. Plants like *Ancistrocladus abbreviatus* from Cameroon has been reported to show a strong anti-HIV activity due to michellamine B and has been developed for treating people living with HIV/AIDS [23]. Iwu *et al*. [4], Okigbo *et al*. [8], Boakye-Yiadom *et al*. [33] and Sawer *et al*. [34] investigated the antimicrobial activities of phytomedicine which are effective in curing infectious human pathogens like *E. coli, Candida albicans, Staphylococcus aureus, Bacillus sp* etc. The actions

of phytomedicine often extend beyond symptomatic treatment of diseases [4]; for example, *Hydrastis Canadensis* not only has antimicrobial properties but also promotes optimal activity of the spleen in releasing compounds by increasing the blood flow in the spleen as reported by Murray [35]. Finally, they are usually less expensive than synthetic drugs [7].

2.4 Economic Benefits

The interest in natural therapies has increased international trade in phytomedicine and attracted most pharmaceutical companies interested in commercializing Phytomedicines as recorded by Calixto [7]. The production, processing and sale of phytomedicine products create employment for the producing countries [25]. According to Calixto [7] and Blumenthal [20], the European market alone reached $7 billion in 1997; the German market corresponds to about 50% of the European market, about $3.5 billion which represents about $42.90 per capita; the market in France corresponds to about $1.8 billion, Italy follows with $700 million, UK has $400 million, Spain and Netherlands have market sales of $300 million and $100 million respectively. The U.S phytomedicine trade reached about $3.2 billion in 1996 and 5 billion in 1999 [20-21] as shown in Table 2. Grunwald [22] reported that markets in Asia and Japan reached about $2.3 billion and 2.1 billion respectively. Over $2.4 billion worth of traditional Chinese medicines (TCM) were sold and $400 million worth of TCM were exported out of China in 1993, about $60 million was realized from herbs in 1996 in Malaysia; in Europe, North America and Africa, about 75% of people living with HIV/AIDS patronize complementary and Alternative medicine. As a whole the annual market value of phytomedicine is close to $43 billion (more than some African annual budgets) as reported by Elujoba *et al*. [1] and Enwonwu [36]. Anti-infective agents make up to 24% of the pharmaceutical market [37]. An antimicrobial, *Hydrastis*, had a sale of 4.7% in 1995 [38]. *Hypercium perforatum* (St. John's wort), an antiviral and antidepressant had increased in sales to over 20,000% in the mass market sector in 1997 [39]. About 75% of the population of France has used complimentary or alternative medicine at least once [36] and about 60 million of Americans over 18 years uses phytomedicine in the cure of colds, burns, headaches, depression, diarrhea and others [7].

2.5 African medicinal plants in world market

Many African phytomedicines are well known in the international markets and Africa is one of the main world producers of the plants [1, 23]. Examples are *Ancistrocladus abbreivatus*, a Cameroon plant with Anti-HIV potential [23], *Rauvolfia vomitoria, Zingiber officinale* (Ginger), *Capsicum annum* contains capsaicin, phytostigmine or eserine used to treat eye diseases, a product from *Phytostigma venenosum. Catharantus roseus*, Madagascar Rose periwinkle is used in management of Hodgkin's disease and Leukemia [1]. The plant *Chrysanthemum cinerariifolium* produces a class of insecticides [29]. *Cinchona* yields quinine, a key anti-plasmodial drug for the treatment of malaria [26]. *Agava sisalana*, a Tanzanian export plant is used in manufacturing of steroidal drugs like corticosteroids and oral contraceptive [1]. According to Sofowora [23], *Prunus africana* is exported by Cameroon, Kenya and Madagascar and used for prostate gland hypertrophy. *Tamarindus indica* is exported by Egypt to neighboring countries as insecticides (Table 3).

3. DEVELOPMENT OF PHYTOMEDICINE IN AFRICA, PROBLEM ENCOUNTERED

3.1 The relevance of WHO in African traditional medicine

The WHO has helped most developing countries of the world by utilizing several expert committees' policy decisions and resolutions in providing guidelines that will aid countries to develop and utilize their indigenous medicines for their national health agenda [2]. In Africa, the health agenda is targeted at the recognition and development of phytomedicines by indigenous medical and pharmaceutical research scientists. This has lead to the African Heads

of State declaring the first ten years of the millennium (2001-2010) as the "Decade of Traditional Medicine in Africa" celebrated 31st August every year; this was done to make sure that phytomedicine is recognized and appreciated in the health sector as reported by Elujoba *et al*. [1].

WHO [40] has proffered a memorandum that will help African member states in institutionalizing African traditional medicine into their health system. This has been adopted by some countries in Africa within their health agenda [1]. The African Regional Director of WHO has placed a big challenge before the different African Research centers on traditional medicine that must be able to cure priority diseases in Africa. Malaria, HIV/AIDS, Sickle-cell Anemia, diabetes and Hypertension [1].

3.2 Different steps in the integration of traditional medicine into the health scheme (WHO Guidelines and memorandum)

WHO [40] has provided guidelines for institutionalization of traditional medicine into the health scheme. The steps include:

1. **Political Recognition:** The government and heads of state should be aware and help in the development of traditional medicine; this has already been achieved when the African Summit of Heads of State declared 2001-2010 as 'Decade of African Traditional Medicine'. Research on traditional medicine for the treatment of priority disease to be given more importance [1].
2. **Development of policy, legal and regulatory framework:** Government should formulate national policies, legal frameworks and registration. WHO has provided guidelines for the assessment of herbal medicine [40]. There is need to establish regional regulatory mechanisms for regulating herbal medicine as reported by Calixto [7], national expert committees, national programmes and training programmes for health [1].
3. **Promoting Scientific research on Traditional medicine and collaboration work:** Scientific research should be conducted on safety, efficacy and quality of traditional medicine as proposed by WHO [5]. Countries of Africa are doing a lot on this, conducting researches to validate claims made on quality, safety, efficacy of traditional medicine used for the management of priority disease like malaria, HIV/AIDS, sickle-cell anemia, diabetes and hypertension [1]. Collaboration of traditional medicine practitioners with others in the scientific community is very crucial for the supply of initial information on the plants to the scientists; it is achieved through staff exchange and training, sharing of expensive equipment and joint publications [41]. This has been achieved in Africa with countries like Burkina Faso, Madagascar, Mali and Tanzania making partnership arrangements between Traditional herbal practitioners and the private sector for the integration of traditional medicine [1].
4. **Ensuring that intellectual property rights are protected:** intellectual property rights are a priority item on the agenda of member states to protect indigenous knowledge about traditional medicine [1, 40] and legislation should be made on this [7].
5. **Disseminating appropriate information to the general public on the use of traditional medicine:** Appropriate information should be given to the general public to empower them with knowledge and skills for the proper use of traditional medicine [40]. This is achieved through organization of seminars to raise awareness as recorded by Makhubu [41].
6. **Providing a good economic environment:** The government should ensure that a good economic, political and regulatory environment is established for local production by traditional herbal practitioners as well as develop industries that can produce standardized remedies to increase access [40]. Provide funding for their smooth operations.

4. CHALLENGES IN THE USE AND DEVELOPMENT OF PHYTOMEDICINE

There are many factors hindering the development of phytomedicine in Africa and these problems have to be fully addressed so as to move the African Health Agenda forward. Such problems include:

- Development of drug from its natural source is not an easy task and is more difficult than synthetic drug development; formulation of phytomedicine particularly in crude-drug form requires a specialized expert area that requires training and experience [1].
- Lack of standardization and quality control of the herbal drugs used in clinical trials [7, 41] and occult practices [41].
- The risk of side effect due to toxicity, over-dosage, interaction with conventional drugs as recorded by Calixto [7], Ernst [42] and several manufacturing problems such as misidentification of plants [7], lack of standardization, failure of good manufacturing practice, contamination as a result of field microbial contamination, poor packaging, chemical used, the environmental condition (temperature, light exposure) [1, 7], substitution and adulteration of plants, incorrect preparation and dosage [7].
- Imprecise diagnosis and dosage for phytomedicine [7, 41].
- There is lack of collaborative research among TMP's, Orthodox medical practitioners and scientists [1, 41]. As a result, there is a danger of losing valuable ethnomedical knowledge that the TMPs have concerning the plant and other aspects of the medicinal system that are intrinsically part of their lives [41].
- Inadequate randomizations in most studies. Patients are not properly selected and the numbers of patients used in most trials are insufficient for the attachment of statistical significance [7].
- Problem of serious attention, energy, resource mobilization commitment and the required political will [1].
- Communication problem is an obstacle between the TMPs and the scientists [41].
- There is wide variation in the duration of treatment using herbal medicine [7].
- Domestication: It is difficult to convince members of a community to trust phytomedicine after a long use of Orthodox medicine, as assessed by Makhubu [41].
- There is absence or inadequate record of what is available and many species are becoming extinct because they are not cultivated and protected from indiscriminate harvesting [41, 43]. Also, the traditional healers are of advancing age and dying [44].
- Unfavourable legislation such as witchcraft Act of 1901 [41].

4.1 Solutions

The quality and stability of phytomedicine is achieved by the use of fresh plants, regulated physical factors like temperature, light, water availability, cultivation of plants in place of wild-harvested plants, because they show smaller variation in their constituents. The standardization of phytomedicine can also be achieved by the use of chromatography, infra-red and ultraviolet (UV) spectrometry [7].

The African pharmacognosists, pharmacologists, pharmacists, physicians have to learn, acquire, document and use traditional medicine to help curtail the extinction of plants and human resources [44]. Workshops with TMPs have to be conducted to break the communication problem between the TMPs and Scientists, and human resources can be obtained through individual contacts as recorded by Makhubu [41]. Collaborative work could be achieved through staff exchange and training and funding for capital building; the government should help in funding researches on phytomedicine; the private sector as well as non-governmental agencies should also help finance researches; organization of seminars to raise awareness to the general public on the benefits of medicinal plants and also remove the perception that scientists are out to harness their knowledge for money making; abandoning outdated legislation (such as witchcraft Act, 1901) and passing new legislation to protect

indigenous traditional knowledge and for the integration of traditional medicine into the health scheme [41].

4.2 Future suggestions on the development of phytomedicine in Africa

As medicinal plants are going global with increasing demand in the phytotherapeutic market, some factors have to be put in mind in order to meet the world herbal medicine's standard of safety and efficacy. The following factors must be emphasized in Africa for the development of phytomedicine

- Emphasis on well-controlled and randomized clinical trials to prove the safety and efficacy of herbal medicine. With the growth of the botanical market, the quality, efficacy and safety of phytomedicine used in clinical trails has to be improved so as to produce standardized drugs [7]. Researches on traditional medicines should be made to develop novel therapeutic methods.
- An improvement in the processes of regulation and global harmonization of phytomedicine. The integration of African traditional medicine into the health system should be in a way to bring harmony between traditional and modern system of health care with minimum threat to each other [1, 7].
- Greater emphasis should be placed on collaboration work with TMPs and other scientists in order to bring traditional healers closer to scientists by engaging healers in laboratory work, training them as well as get information on traditional prescriptions for specific diseases [41].
- Emphasis has to be placed on domestication, production, biotechnological studies and genetic improvement of medicinal plants. The domestication of plants will help in reducing effects associated with wild-harvested plants, avoid misidentification and field contamination. Increase the quality of raw materials and yield through genetic breeding and selection. Production of phytomedicine with resistance to microorganism-induced diseases [7].
- Detailed legislation on the ownership of intellectual property right has to be made [7, 41].

5. CONTRIBUTIONS OF SOME RESEARCH CENTERS IN AFRICA AND CONCLUSIONS

Some centers have been formed in Africa to help in carrying out clinical trials, production of standardized drugs and regulatory work.
The centers include:

- **Center for scientific research into plant medicine, Ghana:** They have helped to make sure that drug production is carried out to provide well formulated, suitable, standardized and safe preparations from plants for clinical evaluation, utilization and monitoring in a clinical setting.
- **Center for research on pharmacopoeia and traditional medicine in Rwanda-** produces drugs which are used in curing different diseases.
- **The "village chemist" in Development of pharmacognosy, Obafemi Awolowo University, Ile-Ife, Nigeria:** Manufactures standardized and efficacious phytomedicine for managing different likely infections associated with people living with HIV/AIDS, like antithrush, antifever, antidysentery and antidiarrhea, anticough and anti-infective against skin pathogens and diseases.
- **Swaziland center for research in medicinal and indigenous food plants, University of Swaziland, Swaziland:** They analyze medicinal plants collected by rural people familiar with that the traditional medical system and study's ethnobotanical information on medicinal plants administered by TMPs.
- **Department of traditional medicine, Bamako, Mali:** They keep ethnobotanical information on medicinal plants in rural areas of Mali and researching on their plants to validate claims.

In general, intelligent application of traditional therapies (with proper conducted double-blind clinical trials) will make useful contributions to alleviating sickness and suffering in Africa. Efforts should be made to protect plants from going extinct because a source of health and wealth lies in them. The people and Orthodox practitioners need to be given appropriate information on phytomedicine in other to use them and apply them in the health care delivery system. The integration or harmonization of phytomedicine should be developed in such a way to work hand in hand with orthodox medicine with minimum threat to each other.

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