Chapter

Introductory Chapter: Traditional and Complementary Medicine

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1. Phytotherapy

Plants are man's first medicines. In ancient times, "medical" care mainly involved using plants as medicines. Throughout history, people all over the world have used herbs to maintain and improve health into the art of healing. A constant process of searching, testing, and verifying in all cultures across the globe resulted in the development of an empirical science. Many plants have an established place within scientific medicine and are used for a broad range of health conditions. A herb is a plant or its part used for its scent, flavor, or therapeutic properties. They are sold as tablets, capsules, powders, teas, extracts, and fresh or dried plants.

Herbal medicine as the oldest form of health care is the synthesis of therapeutic experiences of generations for over hundreds of years and has gained popularity again in today's medical practice with over 85% of the world's population using phytotherapeutic medicines according to WHO [1].

The increase in the use of herbal products is due to their cultural acceptability, availability, affordability, efficacy, and safety claims. Primitive humans distinguished useful herbs with beneficial effects from those that were inactive or toxic. The basis of modern medicinal drugs such as aspirin, morphine, digitoxin, and quinine is through scientific validation of herbal medicine. Review of different national pharmacopeia reveals that at least 120 distinct chemical products/moieties from herbal sources have been utilized as lifesaving drugs.

In 2010, the inventory of a British-American team of researchers revised the previously stated number of plants down from 900,000 plants to between 300,000 and 400,000 of which only 6% have been screened systematically for their biological activity and 15% have been investigated phytochemically and just under 10% have had any form of research carried out into the possible use as medicines. It is predictable that natural compounds and their derivatives comprise nearly 60% of all drugs in clinical use and medicinal plants contribute not less than 25% [2].

In medical systems based on herbalism, folklore, or shamanism, written documents do not exist, and the herbal formulations are often kept secret by the practitioners, making the information more difficult to access [3].

The practices and the philosophy of each herbal medicinal system are influenced by their region: Ayurveda, a health care system that has been founded by ancient Hindu healers and saints, has been still used in India for over 5000 years. Its materia medica provides a comprehensive description of over 1500 herbs and 10,000 formulations. The Indian government has recognized Ayurveda to be a complete health care system in comparison with western Medicine and has compiled and preserved traditional medicinal knowledge in the public domain with The Traditional

Knowledge Digital Library (TKDL). Ayurgenomics aim to provide a base for human classification, diagnostics, and customized medicine with Ayurvedic concept of Prakriti from pharmacogenomics perspective, and AyuSoft has developed interactive software based on Ayurvedic classics as a decision support system. Herboprint uses three-dimensional HPLC to develop tools for activity-based standardization of botanicals.

A lot of medicinal plants, traditionally used for thousands of years, are present in a group of herbal preparations of the Indian traditional health care system named Rasayana proposed for their interesting antioxidant activities.

As metabolic diseases and age-related degenerative disorders are closely associated with oxidative processes in the body, the use of herbs and spices as a source of antioxidants to combat oxidation warrants further attention on validating the antioxidant capacity of herbs and spices after harvest, as well as testing their effects on markers of oxidation in parallel with clinical trials aiming to establish antioxidants as mediators of disease prevention. From a dietary perspective, the functionality of herbs and spices is exposed through consideration of their properties as foods. Through evidence-based frameworks for substantiating health claims related to foods, recommendations are warranted to support the consumption of foods rich in bioactive components, such as herbs and spices in the overall maintenance of health and protection from disease. In the book, a chapter is dedicated to the antioxidant properties of natural products [4–6].

In China, their own system known as the Traditional Chinese Medicine has been used throughout history. The oldest known herbal book in the world "The Devine Farmer's Classic of Herbalism" was compiled in China about 2000 years ago, including numerous herbal pharmacopeias and various monographs on specific herbs and their composition information.

The first textbook fully devoted to the description of herbal drugs is the Shennung-pen-ts'ao ching (ShenNung's Classic of Pharmaceutics) was written during the later Han period (25–220 AD). The literature of Chinese Materia Medica developed by continuous addition of new drugs as well as re-evaluation and addition of new indications for existing herbs during the centuries has been a valuable source for the acquisition of ethnopharmacological data and the development of new medicinal plants by studying the ancient textbooks.

The first compound derived from Chinese herbal remedies to enter the western market was ephedrine, an amphetamine-like stimulant from ma huang (*Ephedra sinica*).

Kampo medicine, the Japanese herbal medicine dates back over 1500 years with approximately 148 formulations [7].

In 1873, the Ebers Papyrus, the most ancient Egyptian medicine treaty—dated 1600 BC, was found, proving the use of plants for therapeutic purposes.

During the Trojan War (1200 AC), the plant *Achillea millefolium* was used on wounded soldiers in order to stop bleeding and heal wounds [8].

After the fall of the Roman Empire, the tradition of herbal medicine moved to the monasteries. The writings of famous healers from earlier times were copied, and many monasteries established and maintained herb and medicinal plant gardens, which led to the acquisition of new medico-botanical knowledge.

In Germany, herbal medicine is identified as one of the elements of naturopathy, and approximately 600–700 plant-derived medicines are accessible and prescribed by approximately 70% of German physicians. In 2011, 20% of herbal drugs were sold as prescriptions and 80% over the counter in Germany. In the EU, annual revenues from herbal medicines surpassed US$ 6 billion in 2003.

The National Canadian Institutes disbursed approximately 89 million dollars for research in traditional therapies in 2004.

In 2005, the National Centre for Complementary and Alternative Medicine at the National Institutes of Health in the USA spent about 33 million US dollars on herbal medicine.

In recent decades, the pharmacological properties of numerous medicinal plants and opportunities in phytotherapy have been explored through research projects, reviews, and monographs. These studies confirm that medicinal plants offer new approaches to tackling diseases. Herbal medicine has become a popular form of health care; even though several differences exist between herbal and conventional pharmacological treatments, herbal medicine needs to be tested for efficacy using conventional trial methodology. The public is often misled to believe that all natural treatments are inherently safe, but herbal medicines do carry risks. The triad absorption/metabolism/efficacy of herbs and their extracts is still an unsolved problem in judging their health effects. Some side effects such as allergic reactions, mutations, intoxication, teratogenesis, carcinogenesis, and medication interactions may occur if the use of the phytotherapeutic or medicinal plant is unrestricted. The lack of a stricter control of these medicines enables contamination by heavy metals, conventional drugs, herbicides or pesticides [9].

Based on World Health Organization reports, resistance of bacteria to antibiotics is a major global health challenge now and in the future. Different strategies such as inhibition of multidrug resistance pumps and biofilm formation in bacteria and development of new antibiotics with novel mechanism of action have been proposed to tackle this problem. Flavonoids, a large class of natural compounds, have been extensively studied for their antibacterial activity, in more than 150 articles published since 2005 and especially chalcones showed up to sixfold stronger antibacterial activities than standard drugs in the market. Some synthetic derivatives of flavonoids also exhibited remarkable antibacterial activities with 20- to 80-fold more potent activity than the standard drug against multidrug-resistant Gram-negative and Gram-positive bacteria (including *Escherichia coli*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus*). Some of the flavonoids (i.e., quercetin) with a strong background of use in clinical trials are good candidates for further clinical studies as antibiotics alone or in combination with conventional antibiotics [10].

In the concept of the "doctrine of signatures," the healing effect of plants was deduced from their taste, shape, color, and other characteristics, for example, celandine (*Chelidonium majus* L.) being used as a remedy for the gallbladder and liver because of its yellow sap, orchids being used as an aphrodisiac because of their tubers resembling male testicles, and walnuts being used for mental illnesses because of their appearance resembling the surface of the brain.

The Nobel Prize in Physiology and Medicine 2015 was awarded for the discovery of two main natural products: (1) avermectin, a macrocyclic lactone isolated from the soil microorganism *Streptomyces avermitilis* (and its derivative ivermectin) and (2) artemisinin, a sesquiterpene lactone containing a peroxide bridge, isolated from the plant *Artemisia annua* L. (Asteraceae) [11].

The World Health Organization (WHO) defines herbal medicine as a practice, which includes herbs, herbal materials, herbal preparations, and finished herbal products, which contain as active ingredients parts of plants or other plant materials or combinations. These herbs are derived from plant parts such as leaves, stems, flowers, roots, and seeds.

Modern or scientific herbal medicine is also called phytomedicine or phytotherapy. Phytotherapy is a science-based medical practice with more traditional approaches, such as medical herbalism, which relies on an empirical appreciation of medicinal herbs linked to traditional knowledge.

Phytotherapy is defined as the study of the use of extracts of natural origin as medicines or health-promoting agents in an allopathic discipline, because they are

directed against the causes and the symptoms of a disease. In Germany, phytotherapy is classified as a discipline of natural orthodox science-oriented medicine, with scientific requirements of the chemically defined substances in terms of quality, safety, and efficacy. Modern mass production of natural products as food supplements or herbal medicines may result in remedies that can differ greatly (dosage form, mode of administration, herbal medicinal ingredients, methods of preparation, and medical indications) from the traditions that form the basis for their safety and effectiveness, and an acceptable quality standard. The WHO has published monographs on the quality control, safety, and efficacy of selected medicinal plants and recommendations on their cultivation.

According to the World Health Organization, phytomedicine is defined as herbal preparations produced by subjecting plant materials to extraction, fractionation, purification, concentration, or other physical or biological processes. These preparations may be produced for immediate consumption or the basis for other herbal products. Such plant products may contain recipient or inert ingredients, in addition to the active ingredients.

Paraherbalism describes alternative and pseudoscientific practices of using unrefined plant or animal extracts as unproven medicines or health-promoting agents [12].

An herb may be any part of a plant including its leaves, stem, flowers, roots, and seeds. Herbal products may be raw or commercial preparations used to treat illnesses. Raw herbal products (leaves, seeds, or teas) are more used in less developed countries and commercial herbal preparations (tablets or pills) are more used in developed countries.

WHO published the requirements for clinical trials of herbal products, which contain the following definitions:

1. Herbal substance—material derived from the plant(s) by extraction, mechanical manipulation, or some other processes

2. Herbal product—the herbal material administered to clinical subjects

3. Herbal product synonyms—herbal remedy, herbal medicine, herbal drug, and botanical drug [13]

Herbal drugs, called phytochemicals, are the secondary metabolites of plants. Some are toxins, used to deter predation; some are pheromones, used to attract insects for pollination; others are phytoalexins, which protect against microbial infections; and yet others are allelochemicals, which inhibit rival plants competing for soil and light.

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.

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.

The following are characteristics of the phytomedicine:

- The active principle is frequently unknown.
- Standardization, stability, availability, and quality control are not easy.
- Well-controlled double-blind clinical and toxicological studies to prove their efficacy and safety are rare.
- They are cheaper than synthetic drugs.
- 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 a wide range of treatment, especially of certain diseases where conventional medicine fails.

They are gentle, effective, and often specific in function to organs or systems of the body [14].

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, psychopharmacological products with sedative and anxiolytic action are 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 combatting certain symptoms. Its balancing effect prevents mental disorders and unbalanced mental condition.

The action of phytomedicines for the respiratory system is not limited to neutralizing the symptoms of any disease, but they also 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) and *Allium sativum* (garlic). Naringenin chalcone as the effective constituent of tomato extracts has been shown to inhibit the release of histamine from mast cells in the initial phase of inflammation and decrease the eosinophils and eosinophil cationic proteins by significantly improving nasal obstruction, rhinorrhea, and sneezing [15].

Phytomedicines are good dietary supplements, which are nutritive and replenish the body. For example, sunflower seed (*Helianthus annuus*) provides vitamin B6 (Pyridoxine).

Phytomedicines are effective in curing human pathogens like *E. coli* and *Candida albicans*, beyond symptomatic treatment of diseases and limit side effects associated with synthetic antimicrobial drugs. 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.

Recognition and application of phytomedicine depend on evidence-based clinical data. Phytomedicine can only enter in professional clinical application if safety, efficacy, and quality are proven in a comparable manner to conventional drugs. For this purpose, it is mandatory to conduct well-designed clinical trials. Awareness of Good Clinical Trial Practice and provision of knowledge worldwide is the existential foundation for proper scientific development [16].

"Medicinal plants" are neither phytomedicines nor phytotherapeutics. Once classified as a medicine, it is subject to the ethical standards defined by World Health Organization (WHO), and has to go through careful production processes from the time of collection and formulation until the time of packaging and distribution.

A plant may contain even thousands of chemical compounds acting in a synergistic way. Many conventional test methods are not always able to cope with the complexity of plant extracts to confirm the empirical and traditional use of a herb.

Many big pharmaceutical companies and scientists are returning to nature's apothecary in the search of new medicines [17].

Rational drug discovery from plants started when the German apothecary assistant Friedrich Sertürner isolated the analgesic and sleep-inducing agent from opium, which he named morphium (morphine) after the god of dreams, Morpheus, in 1805. This was followed in succession by many other herbal remedies or phytopharmaceutical substances (referred to in international terminology as HMPs or Herbal Medicinal Products). Strychnine from the poison nut tree (Strychnos nux vomica) in 1819, caffeine from the coffee bean (*Coffea*) in 1819, quinine from red cinchona (*Cinchona pubescens*) in 1820, codeine from opium in 1832, digitoxin from the purple foxglove (*Digitalis purpurea*), strophanthin from the seeds of the African climber (*Strophanthus gratus*), and atropine from deadly nightshade (*Belladonna atropa*) were important milestones in the discovery and isolation of plant-based constituents.

H.E. Merck in Darmstadt (Germany), the first apothecary extracting morphine and other alkaloids, was the first progenitor of pharmaceutical companies, which subsequently have produced natural products by chemical synthesis in order to facilitate production at higher quality and lower costs. Salicylic acid was the first natural compound produced by chemical synthesis in 1853.

The modern pharmaceutical industry laid its scientific and financial foundation after the discovery of penicillin (1928) from microbial sources. The therapeutic use of extracts and partly purified natural products has then been replaced by the use of pure compounds. For example, in the area of cancer, over the time frame from 1940s to the end of 2014, of the 175 small molecules approved 131, or 75%, are other than "S" (synthetic), with 85, or 49%, the actually being either natural or directly derived products.

Many big and medium-sized pharmaceutical companies have leaved their natural product research programs to academic universities and start-up companies [18].

Ethnobotany, as a research field of science, has been used for the documentation of indigenous knowledge on the use of plants for providing an inventory of useful plants from local floras. Plants that are used for traditional herbal medicine in different countries are an important part of the ethnobotanical studies, for the discovery of new drugs and new drug development. Over-harvesting, degradation of medical plants, and loss of traditional medical knowledge in local communities are common problems in the resource areas as well as issues of indigenous knowledge, intellectual property rights, and uncontrolled transboundary trade in medicinal plants [19].

Phytomedicine has become an important alternative treatment option for patients, as they seek to be treated in a holistic and natural way after an unsatisfactory response to conventional drugs.

Medical treatments cover the application of different components of plants (blossom, leaf, stem, and radix), aromatic essential oils, and herbal extracts as herbal teas, via massage as packs or wraps or in therapies using water, steam, or inhalation.

Although these subjects lost their importance in twentieth century because of the modern synthetic treatments, there is a renewed interest today in medicinal plants usage as natural products for the generation of semi-synthetic derivatives.

Currently, the paradigm of medicine has shifted from not only curing clinical diseases but also maintaining good health and enhancing quality of life with the integration of traditional medicine into the modern health care system [20].

2. Homeopathy

In conventional medicine, drugs are generally used to combat the symptoms of an illness. This principle is called allopathy (directed against an ailment) as well as for phytotherapy.

In homeopathy (similar to the ailment), a substance in diluted (potentized) form, which produces certain phenomena in healthy people, has a healing effect for a patient suffering from the same phenomena.

Common features of homeopathy and phytotherapy are that they emphasize a holistic approach and the regulation of self-healing powers and they are based on empirical values.

In determining the outcome of any traditional treatment, both in experimental and clinical settings including *forma mentis*, beliefs, knowledge, and practical abilities of the provider, as well as the positive or negative prejudices of the patient with respect to the provider of the therapy, cultural differences in the acceptability of the treatment and adherence to it, the patient-doctor encounter and differences in access to other treatments should be taken into consideration.

3. Traditional medicine and complementary and alternative medicine (TM/CAM)

The World Health Organization (WHO) distinguishes terminologically between traditional medicine and complementary and alternative medicine (TM/CAM). The WHO refers the term traditional medicine to developing countries (in Africa, Latin America, Southeast Asia, and/or the Western Pacific), as indigenous medicine (Traditional Chinese Medicine, Hindu Ayurveda, Arab Unani, and various forms of indigenous medicine) deeply rooted in history. The WHO uses the term CAM when referring to developed countries.

According to the World Health Organization (WHO), TM is "the sum total of the knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health, as well as in the prevention, diagnosis, improvement, or treatment of physical and mental illnesses, 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 [21].

TM therapies include medication therapies—use of herbal medicines, animal parts, and/or minerals—and nonmedication procedure-based therapies—without the use of medication, as in the case of acupuncture and related techniques, manual therapies, chiropractic, osteopathy, qigong, tai ji, yoga, naturopathy, thermal medicine, and other physical, mental, spiritual and mind-body therapies.

In countries where the dominant health care system is based on allopathic medicine, or where TM has not been incorporated into the national health care system, TM is termed as "complementary," "alternative," or "nonconventional" medicine." The term "traditional medicine" denotes the indigenous health traditions of the world; "complementary and alternative medicines" refer to methods outside the biomedical mainstream, as a set of health care practices that are not part of a country's own tradition and are not integrated into the dominant health care system, particularly in industrialized countries; and "conventional medicine" refers to "biomedicine" or modern medicine. Other terms that describe these health care practices, include "natural medicine," "nonconventional medicine," or "holistic medicine." The terms complementary/alternative/nonconventional medicine are used interchangeably with traditional medicine in some countries [22].

WHO's quality-of-life assessment of many traditional and complementary health systems includes spiritual dimensions of life and well-being, which is related to the sense of the meaning of the self or extending beyond the self. Expectancy

based on belief and attitude causes a placebo, or "meaning response" effect on treatment outcomes in all therapeutic settings.

The traditional and complementary and alternative medicine (T/CAM) have claimed an increasing share of the public's awareness and the agenda of medical researchers. About half the population of many industrialized countries use T/CAM, (United States, 42%; Australia, 48%, France, 49%; Canada, 70%) and the proportion is as high as 80% in many developing countries (China, 40%; Chile, 71%; Colombia, 40%; up to 80% in African countries). Accompanied by a growth in research and associated literature, with an increase in an evidence-based approach, T/CAM has long been practiced both within and outside the dominant health care system. Most research has focused on clinical and experimental medicine (safety, efficacy, and mechanism of action) and regulatory issues, to the general neglect of public health dimensions. Public health research must consider social, cultural, political, and economic contexts to maximize the contribution of T/CAM to health care systems globally. A public health agenda is needed in addition to the focus on experimental research. Public health professionals need to define the public health dimensions of traditional and complementary medicines.

Practices of traditional medicine vary greatly from country to country, and from region to region, as they are influenced by factors such as culture, history, personal attitudes, and philosophy. In many cases, their theory and application are quite different from those of conventional medicine. The theories and concepts of prevention, diagnosis, improvement, and treatment of illness in traditional medicine (both herbal medicines and traditional procedure-based therapies) historically rely on a holistic approach toward the sick individual, and disturbances are treated on the physical, emotional, mental, spiritual, and environmental levels simultaneously taken into account the cultural background. As a result, most systems of traditional medicine may use herbal medicines or traditional procedure-based therapies along with certain behavioral rules promoting healthy diets and habits. Holism is a key element of all systems of traditional medicine.

Traditional medicine has not only continued to be used for primary health care of the poor in developing countries, but has also been used in countries where conventional medicine is predominant in the national health care system. Despite its existence and continued use over many centuries, and its popularity and extensive use during the last decade, traditional medicine has not been officially recognized in most countries. Long historical use of many practices of traditional medicine, including experience passed on from generation to generation, has demonstrated the safety and efficacy of traditional medicine. However, scientific research and evaluation of the traditional medicine are needed to provide additional evidence of its safety and efficacy, considering knowledge and experience obtained through the long history of established practices.

With the tremendous expansion in the use of traditional medicine worldwide, safety and efficacy as well as quality control of herbal medicines and traditional procedure-based therapies have become important concerns for both health authorities and the public. Various practices of traditional medicine have been developed in different cultures in different regions without a parallel development of international standards and appropriate methods for evaluating traditional medicine. Governments and researchers, among others, are increasingly requesting WHO to provide standards, technical guidance, and information to ensure that traditional medicine is used properly and to determine how research and evaluation of traditional medicine should be carried out.

Consequently, education, training, and research in this area have not been accorded due to attention and support. The quantity and quality of the safety and efficacy data on traditional medicine are far from sufficient to meet the criteria

needed to support its use worldwide. The reasons for the lack of research data are due not only to health care policies but also to a lack of adequate or accepted research methodology for evaluating traditional medicine. It should also be noted that there are published and unpublished data on research in traditional medicine in various countries, but further research in safety and efficacy should be promoted, and the quality of the research should be improved.

Since 1991, WHO has developed and issued a series of technical guidelines such as guidelines for the assessment of herbal medicines, research guidelines for evaluating the safety and efficacy of herbal medicines, and guidelines for clinical research on acupuncture. However, these guidelines are still not sufficient to cover the many challenging issues in the research and evaluation of traditional medicine. In 1997, with the support of the National Center of Complementary and Alternative Medicine, National Institutes of Health, Bethesda, MD, USA, a WHO informal discussion developed draft guidelines for methodology on research and evaluation of traditional medicine.

Traditional medicine (TM), variously known also as ethno-medicine, folk medicine, native healing, or complementary and alternative medicine (CAM), is the oldest form of health care system as an ancient and culture-bound method of healing that humans have used to cope and deal with various diseases that have threatened their existence and survival. Different societies have evolved different forms of indigenous healing methods e.g., Chinese, Indian, and African traditional medicines. Traditional healer, on the other hand, is "a person who is recognized by the community where he or she lives as someone competent to provide health care by using plant, animal, and mineral substances and other methods based on social, cultural, and religious practices" [23].

4. Traditional medicine in Africa

Prior to the introduction of the cosmopolitan medicine, traditional medicine (TM) used to be the dominant medical system available to millions of people in Africa in both rural and urban communities as the only source of medical care for a greater proportion of the population.

The traditional health care systems are still in use by the majority of the people not only in Africa but across the world. In indigenous African communities, the traditional healers treat patients holistically by reconnecting their social and emotional equilibrium based on community rules and relationships unlike medical doctors who only treat diseases in patients. The arrival of the Europeans marked a significant turning point in the history of this age-long tradition and culture. During several centuries of conquest and invasion, European systems of medicine were introduced by colonizers and preexisting African systems were stigmatized and marginalized. Indigenous knowledge systems denied the chance to systematize and develop and even banned in some extreme cases. They were 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. In postindependence period, after a century of colonialism and cultural imperialism, TM has been recognized and held back the development of African traditional health care as an important aspect of health care delivery system in Africa. Despite the "passionate ambivalence," TM is still in use in modern day Africa after hundreds of years of its existence as a major African socio-cultural heritage without much reported cases of adverse effects.

The new health agenda in 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 a whole, the annual market value of phytomedicine is close to $43 billion in all the world (more than some African annual budgets). Many African phytomedicines are well known in the international markets and Africa is one of the main world producers of the medicinal plants. For example, Cinchona yields quinine, an antiplasmodial drug for the treatment of malaria.

The WHO has helped most developing countries of the world by utilizing expert committees' policy decisions, and resolutions in providing guidelines that will aid the countries to develop and utilize their indigenous medicines for their national health agenda. In Africa, the health agenda is targeted at the recognition and development of phytomedicines by indigenous medical and pharmaceutical research scientists. This has lead the African Heads of States to declare the first 10 years of the millennium (2001–2010) as the "Decade of Traditional Medicine in Africa" and to celebrate on 31st August every year to make sure that phytomedicine is recognized and appreciated in the health sector.

WHO has offered a memorandum to help African member states in institutionalizing African traditional medicine in their health system and challenging different African Research centers on traditional medicine to cure priority diseases in Africa, such as malaria, HIV/AIDS, sickle-cell anemia, diabetes, and hypertension.

WHO has provided guidelines for institutionalization of traditional medicine into the health scheme including the below steps:

1. Political recognition: the government and heads of states should develop research on traditional medicine for the treatment of priority diseases as they declared 2001–2010 as "Decade of African Traditional Medicine" at the African Summit of Heads of States.

2. Development of policy, legal and regulatory framework: governments should formulate national policies, legal frameworks, and registration according to the guidelines that WHO has provided for the assessment of herbal medicine to establish regional regulatory mechanisms regulating herbal medicine through national expert committees.

3. Promoting scientific research on traditional medicine and collaboration work: scientific research should be conducted on safety, efficacy, and quality of traditional medicine primarily used for the management of priority disease like malaria, HIV/AIDS, sickle-cell anemia, diabetes, and hypertension as proposed by WHO. Collaboration of traditional medicine practitioners with the scientific community can be achieved through staff exchange and training, sharing expensive equipment and joint publications by making partnership arrangements also with the private sector for the integration of traditional medicine.

4. Ensuring that intellectual property rights are protected: intellectual property rights of the indigenous knowledge about traditional medicine should be protected by particular legislation.

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 through organization of seminars to raise awareness.

6. Providing a good economic environment: the government should ensure a good economic, political, and regulatory environment for local production by traditional herbal practitioners as well as develop industries that can produce standardized remedies to increase access and provide funding for their smooth operations.

There are many factors hindering the development of phytomedicine in Africa:

- Development of drug from its natural source is more difficult than synthetic drug development; formulation of phytomedicine particularly in crude-drug form requires a specialized expert area of training and experience.
- Lack of standardization and quality control of the herbal drugs used in clinical trials.
- The risk of side effects due to:
    - toxicity,
    - over-dosage,
    - interaction with conventional drugs,
    - manufacturing problems such as misidentification of plants,
    - lack of standardization,
    - failure of good manufacturing practice,
    - contamination as a result of field microbial contamination,
    - poor packaging,
    - the bad environmental condition (temperature, light exposure),
    - substitution and adulteration of plants, and
    - incorrect preparation and dosage.
- Imprecise diagnosis and dosage for phytomedicine.
- The lack of communication and collaborative research among orthodox medical practitioners and scientists threaten to lose the ethnomedical knowledge concerning the plant and other aspects of the medicinal system.
- 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.
- Problem of serious attention, resource mobilization, commitment, and the required political will.
- There is a wide variation in the duration of treatment using herbal medicine.

- Domestication: it is difficult to convince members of the community to trust phytomedicine after a long use of orthodox medicine.

- 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. Also, the traditional healers are of advancing age and dying.

- Unfavorable legislation such as Witchcraft Act.

The quality and stability of phytomedicine is achieved by the use of fresh plants, regulated physical factors like temperature, light, water availability, and 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, infrared, and ultraviolet (UV) spectrometry.

The African pharmacognosists, pharmacologists, pharmacists, and physicians have to learn, acquire, document, and use traditional medicine to help curtail the extinction of plants and human resources. Collaborative work can 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 nongovernmental agencies should help finance researches;

organization of seminars to raise awareness to the general public on the benefits of medicinal plants and remove the perception that scientists are out to harness their knowledge for money making;

abandoning outdated legislation (such as witchcraft Act); and

passing new legislation to protect indigenous traditional knowledge to integrate into the health scheme.

As medicinal plants are going global with increasing demand in the phytotherapeutic market, 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 trials have to be improved to produce standardized drugs and to develop novel therapeutic methods with researches on traditional medicines.

- An improvement in the processes of regulation and global harmonization of phytomedicine. The integration of African traditional medicine into the health system should bring harmony between traditional and modern systems of health care with minimum threat to each other.

- Greater emphasis should be placed on collaboration work in order to bring traditional healers closer to scientists by engaging and training them in laboratory work, as well as get information on traditional prescriptions for specific diseases.

- Emphasis has to be placed on domestication, production, biotechnological studies, and genetic improvement of medicinal plants. The domestication of plants will reduce the 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.

- Detailed legislation on the ownership of intellectual property right has to be made.

Research has shown that a number of traditional medicines are effective therapeutic regimens in the management of a wide spectrum of diseases especially those which may not be effectively managed using Western medicines. Furthermore, inadequate accessibility to modern medicines and drugs to treat and manage diseases in middle- and low-income countries, especially in Africa, may have contributed to the widespread use of TM especially in poor households.

Besides accessibility to traditional healers, TM provides an avenue through which cultural heritages are preserved and respected. Indeed, TM practice is in line with the socio-cultural and environmental conditions of the people who use it in Africa.

Traditional medicine is becoming increasingly popular across the world. However, its growth potential has been understudied and poorly appreciated due to existing global political economy of health and any surrounding informal processes.

In developed countries, on the other hand, factors responsible for the widespread use of TM are beyond accessibility, affordability, and cultural compatibility. According to the World Health Organization anxiety about the adverse effects of chemical drugs, improved access to health information, changing values, and reduced tolerance of paternalism are some of the factors responsible for the growing demand for CAM in developed countries.

Traditional medicine in Africa is contrasted with biomedicine. Most traditional medical theories have a social and religious character and emphasize prevention and holistic features. Traditional medical practices are usually characterized by the healer's personal involvement, by secrecy and a reward system. Biomedical theory and practice show an almost opposite picture: asocial and irreligious with professional detachment. Local communities do not expect that basic health care will improve when traditional healers become integrated into the service. They ask instead for improvement of basic health care itself: more services with better access, more dedication and respect from doctors and nurses, and more medicines and personnel. Fieldwork needs to be done at the community level to arrive at a better understanding and assessment of the community's opinion concerning a possible role of traditional medicine in basic health care.

WHO has been working with African nations to integrate scientific and medical models of health to enhance the potentials of traditional medicine in the control of endemic diseases.

Intelligent application of traditional therapies have made useful contributions to alleviate sickness and suffering in Africa. Efforts should be made to protect plants from going extinct. The people and Orthodox practitioners need to be given appropriate information on phytomedicine. 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 [24–26].

In the book one, chapter is dedicated to the traditional medicine in Africa.

5. Biofield therapies

Biofield, a term coined during the US National Institutes of Health Conference in 1992, is defined as "a massless interacting field of energy and information that surrounds and permeates living systems."

Biofield therapies are noninvasive therapies in which the practitioner manipulates individuals' energy field in order to stimulate his/her healing responses.

The National Institutes of Health Center for Complementary and Alternative Medicine (NCCAM) has classified energy medicine therapies into two basic categories: bioelectromagnetic-based and biofield therapies. Bioelectromagnetic-based therapies involve the use or manipulation of electromagnetic fields (EMFs).

Biofield modalities, which sense and modulate surrounding "subtle energy fields" and interpenetrate the human body, have existed for thousands of years in a wide range of cultures. The vital energy concepts, which include the Indian term prana, the Chinese term ch'i, and the Japanese term qi, refer to subtle or nonphysical energies. Similar concepts in the West are reflected in the concepts of Holy spirit, or spirit, and can be dated back to the writings in the Old Testament.

A common thread is the development of specific techniques that use subtle energy to stimulate one's own internal (intrapersonal) healing process, by movement-oriented practices such as yoga, tai-chi, or internal qigong, as part of the experience of meditation or prayer.

External (interpersonal) practices specifically use subtle energies for the process of healing another person, including local or proximal practices such as external Qigong, pranic healing, where a healer transmits or guides energy to a recipient who is physically present as well as distance practices where a healer sends energy to a recipient in a different physical location, such as intercessory prayer or distance healing.

A major distinction in biofield therapies involves whether the practitioner engages the patient's biofield with (hands-on) or without physical contact (hands-off). Some modalities such as Reiki and Brennan healing contain techniques that are both hands-on and hands-off (but in close proximity), others such as Johrei and external qigong are practiced with hands at a slightly further distance from the body.

Biofield therapies are inexpensive compared with the costs of other types of therapy and effective to relieve daily life stress of patients by reduction in tension, anxiety, and pain with minimum side effects.

Biofield activities stimulate specific brain areas allowing for differentiation of certain moods. Humans distinguish between pleasant or unpleasant stimuli, based upon biofield information transmitted to the autonomic nervous system, immune system, and the endocrine system, so biofield therapy exert an influence throughout the entire human body.

The majority of practices intended to affect the body's energy flow do not involve devices. Energy Medicine Practices that benefit energy flow and overall energy in the body include certain forms of exercise, mechanical manipulation, pressure, light, sound, scent, touch, position, the use of electrical current or magnetic pulses, or movement to stimulate the body's own energy systems. Exercises of the energy medicine require a trained and authorized instructor to teach the technique (Pilates, Tai Chi) and rely either on manipulation (Alexander Technique, Cranial-sacral), on movement (Feldenkrais, FlexAware), on positions (yoga) or on scents (aroma therapy). Some practices that focus on particular areas of the body require touching (massage, reflexology, Reiki) and some others do not require touching (medical Qigong).

Although science has provided considerable information about how the body works, it cannot explain yet what differentiates living and nonliving matter and why the placebo effect is stronger than most drugs and the roles of attitude and intention, as well as the mechanisms by which they work, which may or may not be related to the placebo effect [27].

Biofield physiology is proposed as a descriptor for the electromagnetic, biophotonic, and other types of spatially distributed fields that living systems generate and respond as integral aspects of the self-regulation and organization of cell, tissue,

and whole organism. Individual molecules can act as transmitting and receiving antennae in the mediation of efficient intermolecular communication via single photons.

As a means of information transfer, biophotons have the advantages of extremely high speed and the ability to penetrate through cell membranes that present barriers to the diffusion of molecular signals.

Electrical and magnetic fields, as well as biophotons in the full range from ultraviolet to infrared, are detected during normal physiological activity including the resonance signaling, and the modulation of cell function by specific electromagnetic frequencies.

Biologically generated biofields are a spatially distributed set of forces and physical properties that have the capacity to encode information and exert instructive influences on cells and tissues capable of perceiving and being modified by them [28].

Electric fields generated by the intracellular network of microtubules, centrosomes, and chromosomes play fundamental roles in regulating the dynamics of mitosis, meiosis, and a variety of other cellular activities [29].

Electric charge in motion, whether along a wire or a nerve axon, produces a magnetic field in the surrounding space, a type of biofield. Magnetic fields emanating from the body, although extremely weak relative to the geomagnetic field of the earth, are readily detected by superconducting quantum interference device (SQUID)–based magnetometers [30].

The strongest rhythmic electrical and magnetic fields in the body are produced by synchronous activity of arrays of the heart muscle cells and can be detected, as electrocardiogram (ECG) or magnetocardiogram (MCG). The heart's magnetic field also carries information that can also be detected by other persons or animals and can be recorded up to several feet from the body surface.

An example of the informational potential (bioeffectiveness) of the heart biofields is cardiac-induced entrainment, or frequency locking, detected when the R-waves of one subject's ECG become precisely synchronized with the onset of EEG alpha waves of another subject at a distance of up to 5 feet.

Heart fields may also encode psychoemotional information, as indicated by the 75% accuracy rate in detecting discrete emotional states from patterns of heart rate variability.

The electrical and magnetic fields generated by the composite activity of thousands of brain cells are detected as an electroencephalogram (EEG) or magnetoencephalogram (MEG). At a functional level, the electromagnetic activity of neural assemblies modulates neuron synchronization and circadian rhythmicity and the computational and cognitive processes of the brain. More specifically, weak sinusoidal electric fields enhance and entrain physiological neocortical network activity. Transmembrane currents in neurons also produce local electric fields that induce "ephaptic coupling" (nonsynaptic electrical coupling) between adjacent axons, which influences the synchronization and timing of action potential firing in neurons [31].

Another biofield phenomenon is the coherent, ultraweak photon emissions (UPE), detected from cell cultures and from the body surface. The fluctuations in UPE correlate with cerebral blood flow, cerebral energy metabolism, and EEG activity. Photonic stimulation at one end of a nerve increases UPE at the other end. Nonconventional means of UPE-mediated biosignaling include wave propagation within longitudinally oriented neuronal microtubules and passage through membrane-spanning regions of proteins that may serve as "light pipes" [32].

Numerous nonneural electrical fields have been detected and analyzed, including those arising from patterns of resting membrane potentials that guide

development and regeneration, and from slowly varying transepithelial direct current fields that initiate cellular responses against tissue damage. In addition to the high-speed electrical signals conducted along nerve axons, a second communication network, based in ubiquitous epithelial cells, conducts information through varying direct currents, which spread across considerable distances and play key roles in recognizing damage and guiding cell migration necessary for wound healing especially in skin, heart, and cornea as well as in regulating the migration of neuronal path-finding.

Electrical fields—created by either mechanical stress (piezoelectricity) or streaming potentials—in bone, tendons, and fascia regulate the functioning of osteocytes and fibroblasts to adjust the density of supporting tissues in response to loads [33].

Unspecialized "loose" connective tissue, referred as fascia, forms a continuous head-to-toe network surrounding and permeating all tissues and organs. As an extracellular matrix, structured mainly by collagen fibers, fascia provides a supportive and regulatory framework for all organs of the body as it coordinates cellular perception and interpretation of mechanical forces. This extracellular system reaches into the interior of cells via transmembrane bridging molecules known as integrins, which allow information from the fascia to modify cell metabolism and genetic activity. Since collagen structures both conduct and modify photon pulses emitted from biological sources, signaling along collagen fibers serves as a surveillance system of endogenous biofield emission to complement the immune and nervous systems in monitoring tissue health.

Further speculation based on the water-protein relationship along collagen fibers invokes quantum coherence, a state that can occur when all water molecules in a particular domain or region are spinning synchronously, emitting spin or torsion waves. Such spin coherence and quantum coherence enable the collagen matrix to be ultrasensitive to electromagnetic fields in a manner that can be frequency selective due to a quantum phenomenon known as the Larmor Precession [34].

Global coherence is the multilevel integration of diverse biological activities across time and scale accounts for the most salient properties such as long-range order and coordination, rapid and efficient energy transfer, and extreme sensitivity to specific signals.

The receptor system for endogenous and exogenous biofields is a body-wide network that exhibits three types of potential receptor sites: molecular, charge flux, and endogenous field.

An important series of studies on cultured cells identified two examples of the first type of receptor sites—deoxyribonucleic acid (DNA) and the cell membrane—at which exogenous electromagnetic signals exert specific biological effects.

Charge flux sites, the second type of receptor as exemplified by the perturbation of transmembrane calcium fluxes, have been proposed as a generic mechanism by which weak electromagnetic fields affect biological systems.

Low-frequency electromagnetic fields also interact with DNA by accelerating the movement of electrons within the helical arrays of base pairs. While ion channels and ion pumps have major roles in establishing the resting potential of an individual cell, the gap junctions, which are the specialized electrical connections between adjacent cells, allow voltage and current-mediated signals to be propagated across groups of cells. In this manner, spatiotemporal patterns of resting potentials arise to provide bioelectrical guidance during tissue development, regeneration, and cancer suppression [35].

Deletion of the electromagnetic response elements (EMRE) eliminates the ability of the applied electromagnetic field to regulate the target genes, while other genes can be converted from electromagnetic nonresponders to responders by inserting the EMRE at upstream regions.

Sufficient evidence has accrued to consider biofield physiology as a scientific discipline, based on nonlocal, integrated, information-conveying phenomena as well as on emerging molecular details of localized biophysical interactions. Endogenously generated pulses of ultraweak photons, electromagnetic fields, and patterns of distributed membrane voltage are varied forms of physiological activity designated as biofields, each with established properties and proposed biological functions.

While bioelectromagnetics define the mechanisms of local interactions, biofield physiology is more about understanding the integrated, longer-range functions within the whole organism: the former more reductive and the latter more integrative [36].

While the nervous, endocrine, immune, and cardiovascular systems are in continuous intercommunication via electrical and molecular signals, endogenous biofields act as carriers of information between these systems. An example is heart-brain interaction, where several types of cardiac initiated signals appear to exert sequential effects on brain activity. Electromagnetic signals from the heart reach the brain in a relatively instantaneous manner, followed first by a range of neural signals arriving in millisecond timeframes and subsequently by pressure waves and hormonal signals arriving with delays of seconds [37].

Evidence of DNA response elements that respond to specific electromagnetic frequencies, analogous to DNA regions responsive to specific hormones, is an important finding.

Different types of signals mediating rapid/short-acting vs. slower/longer-lasting responses, neurally released adrenaline and hormonally released corticosteroids, respectively, coordinate the stress response. Physiological requirements for ultra-rapid responses may be met by biofields. Raman and infrared spectroscopic techniques are now enabling rapid and sensitive chemical characterization of samples based strictly on the vibrational signatures of the molecules present in a sampling volume. When applied to biological systems, the techniques provide highly complex spectra that document changes taking place in the entire genome, proteome, and metabolome; real-time *in vivo* applications are possible.

Biomarkers, defined as physiological variables that have significant clinical relevance to the population being studied, may include measures of immune, endocrine, psychophysiological, autonomic nervous system (including skin conductance), and other neural functions (including electroencephalography, positron emission tomography). Biomarkers may indicate which physiological systems are affected by biofield therapy but do not necessarily shed light on the pathways by which these changes occur nor on the transduction events by which practitioner activity is converted to patient responses that initiate the cascade of physiological changes [38–42].

An increasing number of physicians and other health care providers have begun integrating biofield therapies into patient care, and a growing number of hospital-based programs offer these modalities to patients. The line between what is "alternative," "complementary," or "integrative" is often blurred when it comes to biofield therapies, their practice, and their use by patients.

In the book, one chapter will be about biofield interpretation.

Healing is a multidimensional process that is strengthened by reducing stress and accessing psychospiritual resources, congruent with their values, beliefs, and philosophical perspectives on life and well-being.

There is a need to re-evaluate all the traditional practices on a scientific base to complement and integrate into the conventional evidence-based medicine. In the last chapter, there is a trial to review and present the current situation and future trends in this integration.

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