

CHAPTER - 1

INTRODUCTION

1.1. Herbal medicine: An introduction

By definition, the word *natural* is an adjective referring to something that is present in or produced by nature and not artificial or man-made. The term *natural products* today is quite commonly understood to refer to herbs, herbal concoctions, dietary supplements, traditional Chinese medicine, or alternative medicine¹.

Medicinal herbs are moving from fringe to mainstream use with a greater number of people seeking remedies and health approaches free from side effects caused by synthetic chemicals. Recently, considerable attention has been paid to utilize eco-friendly and biofriendly plant-based products for the prevention and cure of different human diseases. Considering the adverse effects of synthetic drugs^{2,3} the western population is looking for natural remedies which are safe and effective.

India in a supreme position with respect to richness of medicinal flora and is sitting on a gold mine of well-recorded and traditionally well-practiced knowledge of herbal medicine. This country is perhaps the largest producer of medicinal herbs and is rightly called the botanical garden of the world. It is generally estimated that over 6000 plants in India are in use in traditional, folk and herbal medicine, representing about 75% of the medicinal needs of the third world countries⁴. Three of the ten most widely selling herbal medicines in the developed countries, namely preparations of *Allium sativum*, *Aloe barbedensis* and *Panax* spp. are available in India. Medicinal herbs have been in use in one form or another, under indigenous systems of medicine like Ayurveda, Sidha and Unani. India, with its traditional background, needs to increase its share in the world market. But unlike China, India has not been able to capitalize on this herbal wealth by promoting its use in the developed world, despite their renewed interest in herbal medicines. This can be achieved by judicious product identification based on diseases prevalent in the developed world for which no medicine or palliative therapy is available. India is one of the twelve-mega biodiversity countries in the world. The total number of plant species of all groups recorded from India is 45,000 (the total number may be even close to 60,000 as several parts of India are yet to be botanically explored). Of these, number of seed bearing plants account for nearly 15,000-18,000. India enjoys the benefits of varied climate, from alpine in the Himalaya to tropical wet in the south and arid in

Rajasthan. Such climatic conditions have given rise to rich and varied flora in the Indian subcontinent. In order to promote Indian herbal drugs, there is an urgent need to evaluate the therapeutic potentials of the drugs as per WHO guidelines⁵.

The World Health Organization (WHO) has recently defined traditional medicine (including herbal drugs) as comprising therapeutic practices that have been in existence, often for hundreds of years, before the development and spread of modern medicine and are still in use today. The traditional preparations comprise medicinal plants, minerals, organic matter, etc. Herbal drugs constitute only those traditional medicines, which primarily use medicinal plant preparations for therapy. The classical Indian texts include *Rigveda*, *Athurveda*, *Charak Samhita*, and *Sushruta Samhita*. The herbal medicines/traditional medicaments have, therefore, been derived from rich traditions of ancient civilizations and scientific heritage.

WHO estimates that 4 billion people, 80 percent of the world population, presently use herbal medicine for some aspect of primary health care. Herbal medicine is a major component in all indigenous peoples' traditional medicine and a common element in Ayurvedic, homeopathic, naturopathic, traditional oriental and Native American Indian medicine. WHO notes that of 119 plant-derived pharmaceutical medicines, about 74 percent are used in modern medicine in ways that correlated directly with their traditional uses as plant medicines by native cultures. Major pharmaceutical companies are currently conducting extensive research on plant materials gathered from the rain forests and other places for their potential medicinal value⁶.

1.2. History of herbal medicine⁷⁻¹¹

Herbal medicine is considered to be the most ancient form of healing. It is the oldest and purest form of medicine known to mankind. Herbs have been used in most traditional cultures and have had an extraordinary influence on many systems of medicine. The first generally accepted use of plants as healing agents was depicted in the cave paintings discovered in the Lascaux caves in France, which have been radiocarbon-dated between 13,000-25,000 BC.

No one knows, for sure, when humans began using herbs for medicinal purposes. The first written record of herbal medicine use showed up in 2800 B.C. in China by the

Chinese emperor Shen Nong. He wrote an authoritative treatise on herbs that is still in use today. Shen Nong recommended the use of Ma Huang (known as ephedra in the Western world) against respiratory distress. Since then the use of herbs has gained, and fallen out of, favor many times in the medical field. The timeline that follows shows some of the key dates and major points in the history of herbal medicine.

Prehistoric Era

The oldest herb in history may be ginkgo biloba. Fossils from the Paleozoic era tell us that the ginkgo biloba tree has been on earth for millions of years. Prehistoric tribes of hunter-gatherers would include in their diet any berries, leaves, roots, mushrooms, cacti, seeds, herbs or any parts of any plants that were found to be edible. Over many millennia, various herbs and plants were chewed, made into teas, pounded into pastes, made into oils, gargles and snuffs, and added to various foods and drinks. Over the eons of time, effects of herbs were learned by trial and error. Some plants, such as the hemlock tree, were found to be poison. Herbs such as valerian roots were found to make a person drowsy, while other herbs such as tea, contained caffeine and would help people to feel more awake. Somewhere along the way in history, white willow bark was boiled in water and made into a tea that somehow helped relieve aches and pains and lower fevers. In recent times it was discovered that this tree bark contained salicin, which was later synthesized into acetylsalicylic acid, better known as aspirin. Today aspirin has become the number one selling over the counter remedy around the world.

Ancient Babylon

An ancient Babylonian burial site that was discovered by archeologists contained various preserved medicinal herbs, including marshmallow root. These are thought to be some 60,000 years old and are the oldest intact examples of herbal remedies. In ancient cultures, people were often buried with treasures and items that would help them in the afterlife.

Egypt

Some of the oldest and most complete written records about the use of herbs as supplements were recorded thousands of years ago in Egyptian hieroglyphics. The most famous of these writings is known as the Papyrus Ebers, which note the medicinal uses of

over 700 herbs and plants. Many of the herbs recorded in this document back in 1500 BC are still in use today, aloe vera being one well-known example.

China

Chinese medicine is famous for its extensive use of herbs and plants. For over five thousand years, Chinese herbalists have used ginkgo biloba tree leaves, ginseng roots, Cordyceps mushrooms, teas and many other herbs and health tonics to support good health. China has the longest history of continuous use and learning about medicinal herbs. The first recorded Chinese herbal study, called Ben Cao, is believed to have been written around 2000 B.C. by Emperor Shen Nong. The Emperor studied and wrote about over 300 plants and herbal remedies.

India

In early times, herbs and spices were so valuable that their trade was one of the first forms of organized commerce. India played an important part in the herb and spice trade. In India, the study of medicinal herbs has been ongoing since around 2000 B.C. and is known as Ayurveda which means the "science of life". The herb Gotu kola has been used to help memory throughout the history of India. *Gymnema sylvestre* leaves have been used to help diabetics and dieters overcome sugar cravings.

Biblical Times

In the Bible we read about how Kings traveled from afar to bring frankincense and myrrh as gifts for Jesus. In Ezekiel, Jesus says "the fruit of the tree is for man's meat, and the leaves for man's medicine." In the book of Genesis, God declares "I have given you every herb bearing seed, which is upon the face of the earth, and every tree, in which is the fruit of a tree yielding seed; to you it shall be for meat".

Greece

Herbal medicine and the history of herbs in Greece would not be complete without discussing Hippocrates (460 BC - 377 BC), a Greek physician. He made a system of much that was known in his era and extended that knowledge. Hippocrates used many herbs in his treatment of illness because he believed that disease had natural causes contrary to many contemporaries who held that it was inflicted by Gods. In his day

Parsley was used to treat rheumatism and relieve kidney pain while Tarragon was used to treat toothaches. In the first century AD, the Greek physician Dioscorides made a thorough record of the medicinal uses of over 500 herbs and plants. This record, named *De Materia Medica*, informed and influenced herbalists for centuries afterward.

Rome

Herbal remedies were widely used in the Roman Empire, including crushed mint leaves, basil, oregano and mandrake herb. Other early uses of plants in Rome were for the poisoning of political opponents, and for antidotes to poisons. The Roman emperor Nero created a kind of cure-all potion which remained in use for over 2000 years and may have been the first “patent medicine.” Much of the Roman knowledge was lost when libraries and schools were destroyed by warfare. Many years later, Italy would be home to the first standardized dosage of ingredients. A pharmacopoeia called the *Nuovo Receptario* was published around 1500 B.C and became a standard for pharmacists of the time.

The Middle Ages

After the fall of the Roman Empire, during the “dark ages,” much of the learning and culture of European civilizations was lost. While barbarians ravaged the continent, monks and scribes in unconquered Ireland hand-copied books and written works. This history is told in the book titled “How The Irish Saved Civilization.” Most monasteries also had gardens where Monks grew medicinal herbs. The liquor named Benedictine contains 27 herbs, plants & spices and was thought to be a health elixir. It is named after the religious Benedictine monks that invented it.

The Americas

In the mid 1800’s, American Shakers grew and gathered over 200 kinds of medicinal herbs with religious zeal. They pressed the herbs into bricks and sold them to doctors and pharmacists. People all over the world trusted the Shaker label for honesty and quality. Native North Americans used black cohosh for women’s symptoms of menstruation, and now modern scientists have found it to offer an estrogen-like effect upon hormones. In Peru, the bark of the cinchona tree proved useful against malaria and later became the source of quinine sulfate.

Important events in the history of herbal medicine

- 2800 BC : The first written record of herbal medicine use showed up. (Titled: The Pen Ts'ao by Shen Nung).
- 2600 BC : Babylonians recorded the uses for honey, poppy juice, essential oil of cypress and cedar, myrrh, licorice and other remedies which today are used every day by people all around the world.
- 1800 BC : The records of King Hammurabi of Babylon include instructions for using medicinal plants. Hammurabi prescribed the use of mint for digestive disorders. Modern research has confirmed that peppermint does indeed relieve nausea and vomiting by mildly anesthetizing the lining of the stomach
- 400 BC : The Greeks joined the herbal medicine game. Hippocrates stressed the ideas that diet, exercise and overall happiness formed the foundation of wellness.
- 50 AD : The Roman Empire spread herbal medicine around the Empire, and with it the commerce of cultivating herbs.
- 200 AD : The first classification system that paired common illnesses with their herbal remedy appeared. This was prepared by the herbal practitioner Galen.
- 800 AD : Monks took over the herbal field with herbal gardens at most monasteries and infirmaries for the sick and injured.
- 1100 AD : The Arab world became a center of medicinal influence. Physician Avicenna wrote the Canon of Medicine, which gave mention to herbal medicines.
- 1200 AD : Black Death spread across Europe and herbal medicines were used along side "modern" methods such as bleeding, purging, arsenic and mercury with equal, or better, results
- 1500 AD : Herbal medicine and herbalists were promoted and supported by Henry VII and the Parliament, due to the large number of untrained apothecaries giving substandard care.
-

- 1600 AD : Herbs were used in treating the poor, while extracts of plant, minerals, and animals (the “drugs”), were used for the rich. The English Physician, an herbal explaining the practice of herbal medicine, was written during this time
- 1700 AD : Herbal medicine got another high profile endorsement from Preacher Charles Wesley. He advocated for sensible eating, good hygiene and herbal treatments for healthy living
- 1800 AD : Pharmaceuticals began to hit the scene and herbal treatments took a back seat. As side effects from the drugs began to be documented, herbal remedies came into favor again
- 1900 AD : Lack of availability of drugs during World War I increased the use of herbal medicines again. After the war pharmaceutical production increased and penicillin was discovered.
- 2000 AD : EU legislation advocates all herbal medicines should be subject to compulsory clinical testing comparable to that undertaken for conventional drugs. Thus all herbal medicines would be licensed.

Herbal medicines have been documented for almost 4000 years. These medicines have survived real world testing and thousands of years of human testing. Some medicines have been discontinued due to their toxicity, while others have been modified or combined with additional herbs to offset side effects. Many herbs have undergone changes in their uses. Studies conducted on the herbs and their effects keep changing their potential uses. The healing power of plants has been acknowledged by many cultures for thousands of years, and aromatherapy can be said to stem from the various systems of traditional medicine developed by ancient civilizations. Primitive peoples used plants in both their healing traditions as well as in their religious rituals. Indian medicine is traditionally plant based. The most ancient of Indian religious writings contain prescriptions and formulae, as well as invocations and prayers, which address the healing plants themselves. The medicinal plants of India became famous throughout Asia, and many have now found their way into Western medical treatments and aromatherapy. India’s age-old Ayurvedic medical system is increasingly popular in the West as more people become disillusioned with chemical preparations and turn instead to

traditional and holistic forms of healing. Herbs and plants have been used for centuries to improve health. Plants that have demonstrated beneficial effects include herbs, roots, cacti, mushrooms, trees, succulents, seeds, flowers and mosses. Herbal ingredients are used in nutritional supplements, Chinese medicine, cosmetics, perfumes, herbal remedies and in many health foods and beverages.

1.3. Types of herbal medicines¹²⁻¹⁴

Herbal Medicine can be broadly classified into various basic systems:

- *Traditional Chinese Herbal medicine*, which is part of Traditional Oriental Medicine.
- *Ayurvedic Herbal medicine*, which is derived from Ayurveda,
- *Western Herbal medicine*, which originally came from Greece and Rome to Europe and then spread to North and South America.

There are more sophisticated traditional herbal healing methods in Chinese medicine, Eclectic medicine, Cherokee Medicine, Unani Medicine and Ayurveda.

In Chinese medicine herbs (which may include animal and mineral parts) are divided into Superior (food grade), Moderate (to be taken for disease for a short time) and Inferior (toxic, short term) grades.

Cherokee medicine tends to divide herbs into foods, medicines and toxins and to use seven plants in the treatment of disease, which is defined with both spiritual and physiological aspects. Ayurvedic medicine has quite complex formulas with 30 or more ingredients, including a sizable number of ingredients that have undergone alchemical processing, chosen to balance Vata, Pitta or Kapha.

Western Herbal system is today primarily a system of folk medicine.

1.4. Use of herbal medicines¹⁵

Herbs releases volatile oils, antibiotics, aromatics, and other healing chemicals contained within them. Herbs can be prepared in a variety of forms depending on their purpose.

Such techniques include:

- Juice squeezed from herbs.
- Mashing herbs into a paste.
- Decoction or extracting the active ingredients by boiling down the herb in water.
- Hot infusion (like hot tea)- Herb is steeped in hot water.
- Herbal wine made by adding the herb to water and sugar and letting it ferment.
- Tincture, made by combining ground herbs with alcohol, glycerin or vinegar and used internally.
- Liniment - Made like a tincture except it is used externally.
- Syrups - Made by adding herb to a medium such as honey, sugar or glycerin.
- Poultice - Herb is applied directly to a wound or body part and held in place with a cloth.
- Herbal Oil - Usually made with common base oil, such as olive, almond, grape seed, or sesame oils.

1.5. Styles of herbal medicine in practiced¹⁶⁻¹⁹

1.5.1. Western herbal medicine

Herbal Medicine is a general term for the use of plant material, minerals and possibly even animal substances administered individually or in combinations to improve ones health and heal disease. The practice of western herbal medicine is distinguished primarily by the use of herbs commonly found in the west. St. John's Wort, Black Cohosh, Chamomile and Feverfew are some examples of herbs commonly used in western herbal medicine. In general, western herbal practitioners treat your condition as it is defined by western medicine, using St. John's Wort to treat depression, for example. This is in contrast to many other systems of herbal medicine, which diagnose and treat a particular condition according to the theories unique to that medicine. The herbs administered within Western herbal medicine may be raw and cooked into a tea, taken in pill form, extracted into a tincture, or applied externally.

1.5.2. Traditional Chinese herbal medicine

Herbal medicine has been used in China for centuries and is backed by a long and rich history of development, use and research. Chinese herbal medicine is unique in that the diagnosis and treatments are based on the theories of traditional Chinese medicine. Besides discussing the health issues with the patient, a practitioner of herbal medicine use other signs and symptoms such as those found in tongue and pulse to form a TCM (Traditional Chinese Medicine) diagnosis. The common cold, for example, may be diagnosed as "wind-cold invasion" and herbs, which dispel wind and warm cold, may be prescribed. Herbs administered within Chinese herbal medicine are usually raw and cooked into a tea, in a powder form and taken with hot water or in a pill form.

1.5.3. Kampo herbal medicine

Kampo herbal medicine is a system of using herbs based on the theories behind Traditional Chinese Medicine as they have been developed in Japan. As with Japanese acupuncture, the Japanese system of herbal medicine is a refined version of Chinese Herbal Medicine in that they have taken the time to look at a variety of theories and applications of Chinese medicine and determined what works best clinically. Kampo practitioners use well-defined formulas of herbs for conditions based on a person's Chinese medicine-based diagnosis. This is in contrast to a practitioner of Chinese herbal medicine, which may choose from a much wider range of herbs when developing a prescription. Kampo herbs are generally administered in a pill form.

1.5.4. Homeopathy

Homeopathy is a unique form of western medicine that is in use around the world. The theories behind homeopathy are based on the "law of similar" and a homeopathic practitioner uses theory unique to homeopathy to form a diagnosis and decide a course of treatment. Homeopathy attempts to stimulate the body to heal itself by using small amounts of medicines (from plants, minerals, animals or chemicals), which in large amounts might cause the condition for which you are being treated. The idea is loosely related to that behind vaccines. Homeopathic remedies are generally administered in a tiny pill form, which come in a variety of strengths.

1.5.5. Ayurvedic medicine

Ayurvedic medicine is a complete system of medicine from India, which has been used for thousands of years. As with Traditional Chinese Medicine, an Ayurvedic practitioner uses their own unique theories of diagnosis and treatment to heal disease and promote health and wellbeing. Many of the herbs used within Ayurvedic medicine, such as Neem and Arjuna, are commonly found in India and are relatively unique to this system, whereas more common herbs such as Ginger may be used which are also used in other herbal systems. The herbs may be incorporated into meals, prepared as teas or taken in a pill form.

1.6. Biological background of herbal medicine^{20,21}

All plants produce chemical compounds as part of their normal metabolic activities. These can be split into primary metabolites, such as sugars and fats, found in all plants, and secondary metabolites found in a smaller range of plants, some only in a particular genus or species.

The autologous functions of secondary metabolites are varied. For example: as toxins to deter predation, or to attract insects for pollination. It is these secondary metabolites which can have therapeutic actions in humans and which can be refined to produce drugs. The word drug itself comes from the Swedish word "drug", which means 'dried plant'. Some examples are inulin from the roots of dahlias, quinine from the cinchona, morphine and codeine from the poppy, and digoxin from the foxglove. The active ingredient in Willow bark, once prescribed by Hippocrates, is salacin, or salicylic acid alpha-hydroxybenzoic acid, led to the development of aspirin, acetyl-salicylic acid, originally a trade name, patented by Bayer. In 2004 the National Center for Complementary and Alternative Medicine began funding clinical trials into the effectiveness of herbal medicine. Surveys of a scientific approach to herbal medicine can be found in the books Evidence-based herbal medicine and Herbal and traditional medicine: molecular aspects of health.

1.7. Role of herbal medicine in human society²²

People on all continents have used hundreds to thousands of indigenous plants for treatment of ailments since prehistoric times. There is evidence from the Shanidar Cave in Iraq that suggests Neanderthals living 60,000 years ago used medicinal plants. A body that was unearthed there had been buried with eight species of plants, which are still widely used in ethnomedicine around the world.

Anthropologists theorize that animals evolved a tendency to seek out bitter plant parts in response to illness. This behavior arose because bitterness is an indicator of secondary metabolites. The risk benefit ratio favored animals and protohumans that were inclined to experiment in times of sickness. Over time, and with insight, instinct, and trial-and-error, a base of knowledge would have been acquired within early tribal communities.

A survey released in May 2004 by the National Center for Complementary and Alternative Medicine focused on who used complementary and alternative medicines (CAM), what was used, and why it was used. The survey was limited to adults age 18 years and over during 2002 living in the United States. According to this survey, herbal therapy, or use of natural products other than vitamins and minerals, was the most commonly used CAM therapy (18.9%), when all use of prayer was excluded. Herbal remedies are most common in Europe. In Germany, the term apothecary (Apotheke) is still used, and next to prescription drugs one can order essential oils, herbal extracts, or herbal teas. It is even seen as a preferred treatment over the unnecessary overuse of industrialized production of chemical medication.

Herbs contain a vast spread of pharmacologically active ingredients and each herb has its own unique combination and properties. They are classified in modern herbal medicine according to their spheres of action. Many herbs contain ingredients, which provide the whole plant with several such actions, combined in the one medicine. Recognized actions include alterative, anodyne, anthelmintic, anticatarrhal, anti-emetic, anti-inflammatory, antilithic, antibacterial, antifungal, antispasmodic, aperient/laxative, aromatic, astringent, bitter, cardiac, carminative, cathartic/purgative, cholagogue and anticholagogue, demulcent, diaphoretic, diuretic, emetic, emollient, expectorant, febrifuge, galactagogue,

hepatic, hypnotic, rubefacient, sedative, sialogogue, soporific, stimulant, styptic, tonic, vesicant and vulnerary.

1.8. Scientific evidence and herbal medicine²⁰

A substance that has a physiological effect on the body is by definition: a drug. Therefore those herbal remedies that have an effect, do so because of the drugs that they contain; and drugs can be beneficial or harmful. Although some very useful drugs are obtained from plant sources, it should be noted that some of the most deadly poisons are also obtained from plants: the alkaloid poisons for example. There is some scientific evidence to support some herbal remedies. The evidence is not strongly in favour of the remedies that do show up positive results, although it does show up the need for more quality research.

1.9. Various bioactive compounds from herbs²³⁻²⁶

The plant materials contain thousands of chemicals, which act against diseases, and infections of humans and animals when properly used. Plants contain different types of compounds such as resins, rubbers, gums, waxes, dyes, flavors, fragrances, Proteins, Amino acids, bioactive peptides, phytohormones, sugar, flavonoids and bio pesticides.

The beneficial medicinal effects of plant materials typically result from the combinations of secondary products present in the plant. That the medicinal actions of plants are unique to particular plant species or groups is consistent with this concept as the combinations of secondary products in a particular plant are often taxonomically distinct. This is in contrast to primary products, such as carbohydrates, lipids, proteins, chlorophyll, and nucleic acids, which are common to all plants and are involved in the primary metabolic processes of building and maintaining plant cells. India has an ancient heritage of traditional medicine. Materia medica of India provides lots of information on the folklore practices and traditional aspects of therapeutically important natural products. Indian traditional medicine is based on various systems including Ayurveda, Siddha and Unani.

In recent years, there has been a tremendous growth of interest in plant-based drugs, pharmaceuticals, perfumery products, cosmetics and aroma compounds used in food flavors and fragrances and natural colors in the world. There is a definite trend to adopt

plant based products due to the cumulative derogatory effects resulting from the use of antibiotic and synthetics and except for a few cultivated crops, the availability of plant based material is mainly from the natural sources like forests and wastelands. There is a need to introduce these crops into the cropping system of the county, which, besides meeting the demands of the industry, will also help to maintain the standards on quality, potency and chemical composition. India is sitting on a gold mine of well-recorded and well-practiced knowledge of traditional herbal medicine. But, unlike China, India has not been able to capitalize on this herbal wealth by promoting its use in the developed world despite their renewed interest in herbal medicines. This can be achieved by judicious product identification based on diseases found in the developed world for which no medicine or only palliative therapy is available; such herbal medicines will find speedy access into those countries.

Indians have believed from time immemorial that nature provides cures for all illnesses and the curatives are derived from plants. Over a million practitioners of the traditional system of medicines in India, use around 7500 species of plants in the preventive and curative applications, in the codified and oral streams. It is estimated that about 2 million people are engaged in activities like gathering medicinal plants (mostly from their natural habitats, processing them, manufacturing medicines out of them and marketing the same; which includes about 0.6 million licensed, registered medical practitioners of the codified systems of Indian medicine. A cumulative effect of these trends has been a quantum jump in volumes of plant materials extracted and traded within the country and exported outside. Conservative estimates place the economic value of medicinal plant related trade in India to be of the order of Rs.100 billion a year. Apprehensions are being expressed that trends are pointing towards an inexorable monetisation and commercialization of medicinal plants economy. The demand on medicinal plants, on the one hand, is increasing sharply and supplies on the other hand, are dwindling rapidly. Two serious consequences of the widening gap between demand and supply are:

- (a) Suppliers taking advantage of gaps in understanding correct identity of plants and making available incorrect plants.
- (b) Suppliers resorting to adulteration of medicinal plant parts by similar looking plant parts which are not known to be of medicinal value.

It is therefore essential to provide scientific background to establish correct identity of plants and to document diagnostic features to identify and sort out spurious plant parts.

1.10. Risks, benefits and effectiveness of herbal medicine²⁷⁻²⁹

A common misconception about herbalism and the use of "natural" products in general, is that "natural" equals safe. However many plants have chemical defense mechanisms against predators that can have adverse or lethal effects on humans. Examples are poison hemlock and nightshade, which can be deadly, although they are not sold as herbs. Herbs can also have undesirable side effects just as pharmaceutical products can. These problems are exacerbated by lack of control over dosage and purity. Furthermore, if given in conjunction with drugs, there is danger of 'summation', where the herb and the drug have similar actions and add together to make an 'overdose'. In animals, there are other dangers. There may be residues in food from farm animals (e.g. eggs, milk, and meat) or danger of 'doping' in competition animals. The latter may also apply to human athletes.

There is a danger that herbal remedies will be used in place of other medical treatments, which have been scientifically tested for safety and efficacy, resulting in the development or worsening of a medical condition, which could have been better, prevented or treated. There is also a danger that an herbal remedy may itself cause harm, which is unanticipated due to a lack of a full understanding of its composition and biochemical effects.

Herbalists tend to use parts of plants, such as the roots or leave but not isolate particular phytochemicals. They argue that the synergy of the combined substances enhances the efficacy and dilutes toxicity. Western medicine on the other hand prefers single ingredients on the grounds that dosage can be more easily quantified. Dosage is in general an outstanding issue for herbal treatments: while most conventional medicines are heavily tested to determine the most effective and safest dosages (especially in relation to things like body weight, drug interactions, etc.), there are few established dosage standards for various herbal treatments on the market. Furthermore, herbal medicines taken in whole form cannot generally guarantee a consistent dosage or drug *quality* (since certain samples may contain more or less of a given active ingredient).

1.11. Standards, quality control and medical interaction of herbal medicines³⁰

The legal status of herbal ingredients varies by country. For example, Ayurvedic herbal products may contain levels of heavy metals that are considered unsafe in the U.S., but heavy metals are considered therapeutic in Ayurvedic medicine. Heavy metals may be processed in such a way as to inactivate negative aspects, which are not recognized in US or European statutes. In the United States, most herbal remedies are regulated as dietary supplements. Reports in the media have spread the idea that the herbal medicine industry is not well regulated. In fact, the Food and Drug Administration (FDA) regulates it very closely. The FDA reviews an herbal product's labels, manufacturing standards, and contents. It collects reports of adverse effects, issues warnings, and pulls products off the shelves if problems are reported. In addition, the National Nutritional Foods Association (the industry's largest trade association), has developed a program to examine the herbal products and factory conditions of its member companies and give them the right to display GMP (Good Manufacturing Practices) seals of approval on their products. This is a fairly comprehensive process, which resembles the certification process used to accredit hospitals. The program has been in wide operation since 2002.

In consultation with a physician, usage of herbal remedies should be clarified, as some herbal remedies have the potential to cause adverse drug interactions when used in combination with various prescription and over-the-counter pharmaceuticals. Dangerously low blood pressure may result from the combination of an herbal remedy that lowers blood pressure together with prescription medicine that has the same effect. In particular, many herbs should be avoided during pregnancy.

1.12. Importance and scope of herbs³¹

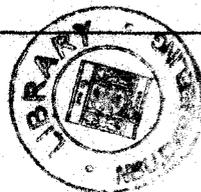
Herbs are staging a comeback and herbal 'renaissance' is happening all over the globe. The herbal products today symbolize safety in contrast to the synthetics that are regarded as unsafe to human and environment. Although herbs had been prized for their medicinal, flavoring and aromatic qualities for centuries, the synthetic products of the modern age surpassed their importance, for a while. Over three-quarters of the world population relies mainly on plants and plant extracts for health care. More than 30% of the entire plant

species, at one time or other was used for medicinal purposes. It is estimated that world market for plant derived drugs may account for about Rs.2,00,000 cores. Presently, Indian contribution is less than Rs.2000 cores. Indian export of raw drugs has steadily grown at 26% to Rs.165 cores in 1994-95 from Rs.130 cores in 1991-92. The annual production of medicinal and aromatic plant's raw material is worth about Rs.200 cores. This is likely to touch US \$1150 by the year 2000 and US \$5 trillion by 2050. Thus, the economic importance of medicinal plants is much more to countries such as India than to rest of the world. In India, drugs of herbal origin have been used in traditional systems of medicines such as *Unani* and *Ayurveda* since ancient times. The *Ayurveda* system of medicine uses about 700 species, *Unani* 700, *Siddha* 600, *Amchi* 600 and modern medicine around 30 species. The drugs are derived either from the whole plant or from different organs, like leaves, stem, bark, root, flower, seed, etc. Some drugs are prepared from excretory plant product such as gum, resins and latex. Even the Allopathic system of medicine has adopted a number of plant-derived drugs, which form an important segment of the modern pharmacopoeia. Some important chemical intermediates needed for manufacturing the modern drugs are also obtained from plants (e.g. diosgenin, solasodine). Not only, that plant-derived drug offers a stable market world wide, but also plants continue to be an important source for new drugs.

Plants, especially used in *Ayurveda* can provide biologically active molecules and lead structures for the development of modified derivatives with enhanced activity and /or reduced toxicity. Some of the useful plant drugs include vinblastine, vincristine, taxol, podophyllotoxin, camptothecin, digitoxigenin, gitoxigenin, digoxigenin, tubocurarine, morphine, codeine, aspirin, atropine, pilocarpine, capsaicin, allicin, curcumin, artemesinin and ephedrine among others. In some cases, the crude extract of medicinal plants may be used as medicaments. On the other hand, the isolation and identification of the active principles and elucidation of the mechanism of action of a drug is of paramount importance. Hence, works in both mixture of traditional medicine and single active compounds are very important. Where the active molecule cannot be synthesized economically, the product must be obtained from the cultivation of plant material.

23065

25 APR 2010



1.13. Action of herbs³²⁻³⁴

A great deal of pharmaceutical research has gone into analyzing the active ingredients of herbs to find out how and why they work. This effect is referred to as the herb's action. Herbal actions describe the ways in which the remedy affects human physiology. In some cases the action is due to a specific chemical present in the herb (as in the antiasthmatic effects of ma-huang) or it may be due to a complex synergistic interaction between various constituents of the plant (the sedative valerian is an example). A much older and far more relevant approach is to categorize herbs by looking at what kinds of problems can be treated with their help. Plants have a direct impact on physiological activity and by knowing what body process one wants to help or heal, the appropriate action can be selected. The qualities of herbs which make them beneficial in treating the human body include:

- *Adaptogenic*: Herbs increase resistance and resilience to stress, enabling the body to adapt around the problem and avoid reaching collapse.
- *Alterative*: Herbs that gradually restore proper functioning of the body, increasing health and vitality.
- *Anthelminitic*: Herbs that destroy or expel intestinal worms.
- *Anti-inflammatory*: Herbs that soothe inflammations or reduce the inflammatory response of the tissue directly.
- *Antimicrobial*: Antimicrobials help the body to destroy or resist pathogenic (disease-causing) microorganisms. Herbs help the body strengthen its own resistance to infective organisms and throw off illness. While some contain chemicals that are antiseptic or poisonous to certain organisms, in general they aid the body's natural immunity.
- *Antispasmodic*: Antispasmodics ease cramps in smooth and skeletal muscles. They alleviate muscular tension and can ease psychological tension as well.
- *Astringent*: Astringents have a binding action on mucous membranes, skin, and other tissue. They have the effect of reducing irritation and inflammation, and creating a barrier against infection that is helpful to wounds and burns.
- *Bitter*: Herbs with a bitter taste have a special role in preventative medicine. The taste triggers a sensory response in the central nervous system leading to a range

of responses, including, stimulating appetite and the flow of digestive juices; aiding the liver's detoxification work; increasing bile flow, and motivating gut self-repair mechanisms.

- *Carminative*: Plants that are rich in aromatic volatile oils stimulate the digestive system to work properly and with ease. They soothe the gut wall; reduce any inflammation that might be present; and ease griping pains and help with the removal of gas from the digestive tract.
- *Demulcent*: Demulcent herbs are rich in mucilage and soothe and protect irritated or inflamed tissue. They reduce irritation down the whole length of the bowel, reduce sensitivity to potentially corrosive gastric acids, help prevent diarrhea, and reduce the muscle spasms that cause colic.
- *Diuretic*: Diuretics increase the production and elimination of urine. They help the body to eliminate waste and support the whole process of inner cleansing.
- *Emmenagogue*: Emmenagogues stimulate menstrual flow and activity. With most herbs, however, the term is used in the wider sense for a remedy that affects the female reproductive system.
- *Expectorants*: Herbs that stimulate removal of mucous from the lungs. Stimulating expectorants "irritate" the bronchioles (a subdivision of the bronchial tubes) causing expulsion of material. Relaxing expectorants soothe bronchial spasm and loosen mucous secretions, helping in dry, irritating coughs.
- *Hepatics*: Hepatics aid the liver. They tone and strengthen the liver and in some cases increase the flow of bile. In a broad holistic approach to health they are of great importance because of the fundamental role of the liver in maintaining health by not only facilitating digestion but by removing toxins from the body.
- *Hypotensive*: Hypotensives are plant remedies that lower abnormally elevated blood pressure.
- *Laxative*: These are plants that promote bowel movement. They are divided into those that work by providing bulk, those that stimulate the production of bile in the liver and its release from the gallbladder, and those that directly trigger peristalsis (wavelike contractions of the smooth muscles of the digestive tract).

- *Nervine*: Nervines help the nervous system and can be subdivided into three groups. Nervine tonics strengthen and restore the nervous system. Nervine relaxants ease anxiety and tension by soothing both body and mind. Nervine stimulants directly stimulate nerve activity.
- *Stimulating*: Stimulants quicken and invigorate the physiological and metabolic activity of the body.
- *Tonic*: Tonics nurture and enliven. They are used frequently in Traditional Chinese Medicine and Ayurvedic medicine, often as a preventative measure. Tonic herbs like ginseng build vital energy.

1.14. Herbal medicine Today³⁵

Herbal medicines are still in use today. In some respects they have gained a new momentum in the medical field. As many people seek alternative treatments and begin to check out Traditional and Eastern Medicine, herbs are becoming more popular. As physicians seek new treatments for many common illnesses they are beginning to revisit the traditional remedies, using herbal medicines.

Pharmaceutical medications, with their potential for harmful side effects and addiction, are becoming less popular. People are seeking alternatives to the modern medical interventions. Improving and maintaining health naturally is a very popular approach to overall wellness.

The herbs used today are generally cultivated for those purposes. Very few herbs are harvested from the wild, with the exception of a few still found in the rainforests and higher elevations. The cultivation of herbs for medicinal uses is a large field and more people are beginning to plant their own herb gardens. Many monasteries continue to grow large herbal gardens within their walls.

Modern herbal medicine takes a syncretic approach, trying to cross-reference the benefits of various herbs and treatments from different traditions, and find the best combination of herbal remedies. It is estimated that upwards of three quarters of the people on the planet use herbal medicine as part of their primary health care regimen.

Many traditional herbs are aromatics the compounds we use to treat illness are an effect of plants conducting chemical warfare on each other and to fend off herbivores. The same

compounds that make many herbs bitter or smell strongly are the ones used in herbal medicine and clinical trials. While there are countless claims that herbal remedies have "no side effect", this is not the case; it's more than the side effects cannot be attributed to one compound in the herbal repertoire, and sometimes this leads to dangers for example, cochineal was used to treat gout (rheumatoid arthritis, and a number of related symptoms), but also has severe side effects on the function of the kidneys and liver, as it has a slow, cumulative toxin.

Herbal medicines are now lining in shelves in most health food stores. As the current health care system becomes overwhelmed to give everyone access to the medical care that they may need, more and more people are turning to the ancient practice of using herbal medicines to self-treat. Despite claims that herbal medicines are absolutely safe and effective, because they come from natural sources, it is important to know that not all herbal medicines are safe and/or effective.

Herbal medicine, or phytotherapy, indicates the use of herbs for remedies. It therefore covers everything from medicinal plants with powerful actions, such as Digitalis and Belladonna, to those with very gentle action, such as chamomile, mint and many others. It should be noted that 'very gentle' action, when referring to chamomile or mint, does not mean they are more or less ineffective, but rather that one would not expect these plants to produce instant and powerful effects like those seen, for instance, after an injection of digitalis or strophanthin. Gentle action also means that these simple medicinal plants do not as a rule have any appreciable toxic effects, and may therefore be safely taken over an extended period of time.

1.15. Future view of herbal medicine³⁵

The number of patients seeking alternate and herbal therapy is growing exponentially. Herbal medicines are the synthesis of therapeutic experiences of generations of practicing physicians of indigenous systems of medicine for over hundreds of years. Herbal medicines are now in great demand in the developing world for primary health care not because they are inexpensive but also for better cultural acceptability, better compatibility with the human body and minimal side effects. Thousand years of traditional use can provide us with valuable guidelines to the selection, preparation and application of herbal

formulation. To be accepted as viable alternative to modern medicine, the same vigorous method of scientific and clinical validation must be applied to prove the safety and effectiveness of a therapeutical product.

1.16. Scenario of herbal medicine in Sikkim Himalaya region^{36,37}

The use of plants as a means to cure/abate certain ailments and disease is an age-old practice throughout the world and the hills of Sikkim are not an exception. Sikkim is a small state of India that falls in the eastern Himalaya ($27^{\circ}34'47''$ to $28^{\circ}7'34''$ N lat and $88^{\circ}34'40''$ to $88^{\circ}57'19''$ E long). The total area of the state is 7096 km^2 , which forms just 0.02% of the total geographical area of the country.

It is criss-crossed by green valleys, high peaks, rippling rivers and is home to exotic species of flora and fauna. Covering 7,096 square kilometers, the State is 113 kilometers long and some 64 kilometers wide. Hills ranging from 300metres above sea level to 7,000metres result in a climate that varies from sub-tropical to alpine.

The unique geographical position and wide range of topography, high fertile soil, sufficient rainfall and presence of large number of perennial stream makes the state of Sikkim one of the treasure houses of bio-diversity in the country. Sikkim has vast reserve of medicinal plants and rich culture of folk medicine. The rich flora of Sikkim has a number of raw drugs described in Ayurvedic texts. There are about 420 plants used by the tribal people for various diseases in Sikkim Himalayas region, out of which few are in utilized on commercial basis. . It is necessary for the establishment of scientifically medical plant farm and bio-chemical laboratories for the identification of active ingredients / molecule from the plant species.

The Sikkim Himalayan people have a close relationship with nature. They use both psychosomatic treatments, which depends on propitiating the gods/spirits and the herbal and mineral medicine. The Himalayan Medicine System (HMS) is not at all systematized and depends upon an oral tradition. The persons, prescribing these medicines, use the traditional knowledge. Some of the Himalayan medicines were known widely and were even exported. For example, Kuth (*Saussurea costus*) was exported to east as is mentioned in *Atharvaveda*. It was also exported to China. Thus HMS is a vast treasure of *herbal* medicine, which needs to be exhaustively studied and used for the economic

regeneration of the local people, as also for the medical benefit of the world at large. We feel that the *Materia medica* of Ayurveda and even the Chinese medicine system may have borrowed heavily from the Himalayan Medicine System. There are effective medicines in Himalayan Medicine System even for incurable diseases.

Sikkim displays extraordinary biological diversity. There are more than 5,000 species of angiosperms, 4,000 species of flowering plants, 450/500 species of orchids and 300 species of ferns and allies.

1.17. Living status of local people and medicinal plants in Sikkim³⁸

Sikkim had traditionally been a major supplier of medicinal herbs to markets in Kolkata and New Delhi. Species like Chirayata (*Swertia chirayata*), Jatamansi (*Nardostachys grandiflora*), Pipla (*Piper longum*), Kutki (*Picrorhiza kurrooa*) and Aconites (*Aconitum* spp.) have been the major produces. Local people have traditionally been collecting herbs from the wild for local as well as market consumption. If the medicinal plants farming is implemented systematically and a scientific approach are adopted, this will pave way for development of the state in a big way in the near future. Herbs are extracted by the local people for ethnic medicinal use, for use in Ayurveda and Tibetan medicines and also for use in modern bio-pharmaceuticals. The state can attain high value addition resulting in higher employment generation and increased income to the people, if propagation of these high value medicinal and aromatic plants is adopted. The preservation, cultivation and adoption of scientific approach in the field of medicinal plants of Sikkim are highly necessary.

In the present study two unexplored plants *Kaempferia rotunda* Linn. and *Eupatorium cannabinum* Linn. of Sikkim Himalayan region have been investigated for their medicinal values, since they are known by the indigenous people of Sikkim for therapeutic properties and are not systematically researched and documented. The aim of this study is to focus on the two species found predominantly, by means of isolation and identification of the plant constituents, be able to relate the therapeutic activity on the basis of literature precedents, to the compounds extracted.

1.18. References

1. Holt GA, Chandra A. Herbs in the modern healthcare environment: An overview of uses, legalities, and the role of the healthcare professional. *Clin. Res. Regulatory Affairs*. 2002, **19**, 83-107.
2. Gijtenbeek JMM, Vanden Bent MJ and Vecht CJ. Cyclosporine neurotoxicity. *J. Neurol.*, 1999, **246**, 339-346.
3. Johnson WC and William OW. Warfarin toxicity. *J. Vasc. Surg.*, 2002, **35**, 413-421.
4. Rajshekharan PE. Herbal medicine in World Science, *Employment News*, 21, Nov-2002, p 3.
5. WHO, General guidelines for Methodology on research and evaluation of traditional medicine, World Health Organization, Geneva, 2000.
6. WHO, in Progress Report by the Director General, Document No. A44/20, 22 March, World Health Organization, Geneva, 1991.
7. Capasso LL. 5300 years ago the Ice Man used natural laxatives and antibiotics. *Lancet*, 1998, **352**, 1864.
8. Ang-Lee MK, Moss J and Yuan CS. Herbal medicines and perioperative care. *J. Am. Med. Ass.*, 2001, **286**, 208-216.
9. Barrett B, Kiefer D and Rabago D. Assessing the risks and benefits of herbal medicine: An overview of scientific evidence. *Altern. Ther. Health Med.*, 1999, **5(4)**, 40-49.
10. Chevalier A. *Encyclopedia of Medicinal Plants*. DK publishing, Dorling Kindersley, London, 2001.
11. <http://www.herbalmedicine.holisticonline.com>.
12. Farnsworth NR, Akerele O, Bingel AS, Soejarto DD and Guo Z. Medicinal plants in therapy. *WHO Bulletin*, 1985, **63(6)**, 965-981.
13. Winston D. *Cherokee Medicine and Ethnobotany*. In: Tierra M, Ed., *American Herbalism*, The Crossing Press, Freedom, CA, 1992.

14. Winston D and Dattner A. The American System of Medicine. *Clinics in Dermatology*, 1999, **17(1)**, 53-56.
15. Collins SB. Learning about herbs. *Beginnings*. 2007, **27(3)**, 20-21.
16. American Chemical Society. *Folk Medicine*, Washington DC, USA, 1986.
17. British Herbal Medicine Association, *British Herbal Compendium*, Vol. 1. Published by the Great Britain, 1992.
18. Chang HK. *The Pharmacology of Chinese Herbs*, Kentucky, CRC Press, 1993.
19. Chang HM and Pui-Hay B. *Pharmacology and applications of Chinese Materia Medica*, Vols. 1 & 2, Philadelphia, World Scientific Publishing Co. Ltd., 1986.
20. Jull A and Mhurchu CN. Review: Herbal remedies, where's the evidence? *J. Royal New Zealand Coll. Gen. Pract.*, 2004, **31(3)**, 193.
21. Beri RM. Phytosterol in some plant materials. *Indian Oil Soap J.*, 1970, **35**, 274.
22. Lietava J. Medicinal plants in a Middle Paleolithic grave. *J. Ethnopharmacol.*, 1992, **35(3)**, 263-66.
23. Shinwari MI and Khan MA. Indigenous use of medicinal trees and shrubs of Margalla Hills National Park, Islamabad. *J. Forest*, 1998, **48(4)**, 63-90.
24. Wink M and Schimmer O. Modes of action of defensive secondary metabolites. In: M Wink, Ed., *Functions of Plant Secondary Metabolites and Their Exploitation in Biotechnology*. CRC Press, Boca Raton, FL, 1999, p 17-112.
25. Kaufman PB, Cseke LJ, Warber S, Duke JA and Brielmann HL. Natural Products from Plants. In: *Bioseparation of compounds*, Kane H, ed. CRC Press, Boca Raton, FL, 1999, p 343.
26. Warner PK, Nambiar VPK and Ganapathy PM. Some Important Medicinal Plants of the Western Ghats, India: A Profile. Medicinal and Aromatic Plants Program in Asia (MAPPA), South Asia Regional Office (SARO), New Delhi, 2001, p 1-2.
27. Bensky D, Steven C, Erich S and Gamble A. *Chinese Herbal Medicine: Materia Medica*, 3rd edn., 2004, p 1054-1055.

28. Vanherweghem JL, Depierreux M, and Tielemans C. Rapidly progressive interstitial renal fibrosis in young women: association with slimming regimen including Chinese herbs. *Lancet*, 1993, **341(8842)**, 387-91.
29. Vanhaelen M, Vanhaelen-Fastre R, But P and Vanherweghem JL. Identification of aristolochic acid in Chinese herbs. *Lancet*. 1994, **343(8890)**, 174.
30. <http://www.oneearthherbs.squarespace.com/safety-regulation>
31. Joy PP, Thomas J, Mathew S and Skaria BP. Medicinal Plants. Tropical Horticulture. eds. Bose TK, Kabir J, Das P and Joy PP, Naya Prokash, Calcutta, Vol. 2, 2001, p 449-632.
32. Goldman P. Herbal medicines today and the roots of modern pharmacology. *Ann. Intern. Med.*, 2001, **135(8)**, 594-600.
33. Ernst E. Harmless herbs: A review of the recent literature. *Am. J. Med.*, 1998, **104(2)**, 170-178.
34. Miller LG. Herbal medicinal: Selected clinical considerations focusing on known or potential drug-herb interactions. *Arch. Intern. Med.*, 1998, **158(20)**, 2200-2211.
35. Pal SK and Shukla Y. Herbal medicine: Current status and the future. *Asian Pac. J. Cancer Prev.*, 2003, **4(4)**, 281-288.
36. Bennet SSR. Ethnobotanical studies in Sikkim. *Ind. For.*, 1983, **109(7)**, 477-481.
37. Bennet SSR. Ethnobotanical studies in West Sikkim. *J. Econ. Tax. Bot.*, 1985, **7(2)**, 317-321.
38. Mudaiya RK, Tiwari RN and Majundar R. Threatened and rare medicinal plants of Sikkim, Bulletin on Medico ethno Botany Research , CCRAS, New Delhi, Vol-xv, 1987, p 24-26.