



Medicinal Plants: Historical and Cross-Cultural Usage Patterns

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PURPOSE: An attempt is made to review the prevalence of medicinal herb use in different societies and the various lines of evidence for its effectiveness for particular health needs and the alleviation of disease conditions.

METHODS: Published scientifically collected data and anecdotal reports representing numerous populations are compiled and evaluated. Original research findings from Caribbean, American, and Caribbean-American samples are included in the comparisons.

RESULTS: Medicinal plant products have been successfully administered both externally and internally in several different forms for a wide range of health problems cross-culturally since prehistoric times. Certain toxic effects and contraindications have also been recorded.

CONCLUSIONS: Many botanical medications contain curative bioactive chemical ingredients which have proven to be valuable as primary or supplemental therapies when carefully applied. Further research will ultimately clarify their appropriate roles in the treatment of diseases and injuries as well as in preventive health maintenance.

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As the author notes in the final section of this article, interest in botanical medicine has been augmented in recent years by the study of complementary and alternative medicine. The article surveys botanical medicaments and provides an extensive bibliography for epidemiologists who may be pursuing studies in this field.

Editor

INTRODUCTION

Several diverse lines of evidence indicate that medicinal plants represent the oldest and most widespread form of medication. Until the last century most medicines were derived directly from plant or animal sources. Despite the increasing use of factory-made synthetic drugs, natural organic healing materials have persisted as the “treatment of choice” for a multitude of health problems in populations throughout the world.

The purpose of the present article is to review previously published and original data on the historical uses and current applications of botanical medicines in a variety of different societies and cultures. Special attention is focused on the scientific evidence for the effectiveness of herbal remedies.

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HISTORICAL BACKGROUND

The healing properties of various plants are recognized and utilized by other primates. A number of species of monkeys and apes have been observed to repeatedly consume particular botanical species containing chemical components that act as analgesics, anti-microbials, anti-inflammatories, immunostimulants, anti-diarrheals, digestive aids, and fertility regulators (1–2; 3, p. 156–165). A recent review article on this intriguing subject reports that monkeys, gorillas, chimpanzees, and humans select some of the same plants for the management of similar diseases, injuries, and other health problems (4).

There is also ample archaeological evidence indicating that medicinal plants were regularly employed by people in prehistoric times. In several ancient cultures botanical products were ingested for biomedically curative and psychotherapeutic purposes. Through extensive experimentation the biodynamic activities of the phytochemical plant constituents were gradually discovered and exploited for specific medical and psychiatric applications. Evidence suggests that the early healers were well aware of the mind–body interconnection and the important role of patient relaxation in medical treatments and in health restoration and rehabilitation (5–7). In a recent review article Merlin (8) evaluates different lines of archaeological evidence regarding psychoactive plant usage in a variety of prehistoric cultures in the “Old World” (Eastern Hemisphere).

Some of the earliest known written records also deal with the subject of healing with medicinal substances. The ancient Egyptians of 3000 to 6000 years ago are credited with developing an elaborate and effective pharmacological

collection of numerous curing materials obtained from natural resources. Nunn (9, p. 137) states: “By far the most common form of treatment recommended in the medical papyri was the use of drugs, drawn from a very wide range of animal, mineral, and vegetable substances and administered in a variety of ways. The ancient Egyptians were renowned for their skill in this respect.” The Egyptian doctors prescribed sedatives, analgesics, gastrointestinal disorder remedies, and medicines for urinary tract diseases and the common cold (9, p. 153–161; 10, p. 444–446). Plant extracts were prepared and taken internally, applied topically, and administered by fumigation and vapor inhalation. The Egyptians are also credited with the early medicinal use of wine, castor oil, marijuana, opium, mints, and beer made from barley and wheat (11). Oakes and Gahlin (10, p. 445) point out that “The Egyptians were the first people to use a number of drugs that modern studies have proved would have been medicinally effective.”

Plant-based therapeutic treatments continued to be augmented later by health-care practitioners in ancient Greece 3000 through 1500 years ago. Dioscorides, an authority on herbs who lived in the first century A.D., is noted for assembling 24 detailed books on over 600 curative plants and their proper uses under the title *De Materia Medica*, the earliest known designation of that terminology (12, p. 521; 13, p. 357).

Following those developments additional discoveries of useful medicinal plants resulted from experimentations in several early historic cultures 1000 to 2000 years ago in China, India, and Tibet. The herbal specialist was recognized as a powerful and influential professional in these societies (14–17). About 1000 years ago healers in the Aztec and Maya Indian cultures of Mexico and Central America were experimenting with natural curing substances. Evans (18, p. 477) notes that Post-Classic “Mesoamericans developed a large and effective pharmacopoeia, formulae for medicines concocted from animals, minerals, and especially plants.” According to Berdan (19, p. 156), the ancient Aztec healers exploited at least 132 medicinal herbs for the treatment of specific ailments ranging from pimples and nosebleeds to gout and epilepsy. Respiratory and gastrointestinal infections were addressed with remedies produced from a combination of different herbal products, and some of the preparations were prescribed to prevent certain diseases.

Another major advancement was achieved in the 18th century with the revolutionary taxonomic work of Swedish naturalist Carolus Linnaeus, whose classifications of thousands of botanical species provided the foundation for the standardized documentation of the relationships and evolutionary histories of medicinal plants. His classic *Systema Naturae* (1735) established the framework for modern biological taxonomy, and his famous works *Genera*

Botanica and *Critica Botanica* (both published in 1737) and *Philosophica Botanica* (1751) deal with the subject of the precise identification of plants and their characteristics, including catalogues with Latin terminology of all species known at that time. In *Species Plantarum* (1757) Linnaeus recorded detailed descriptions of over 5900 plant species. These landmark publications continue to be consulted by botanists, herbalists, horticulturalists, and taxonomists.

Another indication of the lengthy history of botanical medicine is found in its global, cross-cultural distribution. From its original inception in prehistory, medicinal plant exploitation has gradually spread, by both independent discovery and cultural diffusion, to all corners of the earth. Organized, systematic collections of traditional herbal remedies have been described by anthropologists and ethnobotanists in all countries and ethnic groups surveyed so far (20–23).

CURRENT RESEARCH DIRECTIONS

Despite the cross-cultural, universal nature of herbal medicine, scientific research concerning its effectiveness has only recently been conducted. In his “urgent” call to action, Naranjo (24) noted that over 20,000 medicinal plants were recently inventoried in by the World Health Organization (WHO), and at the time of that publication (1995) 250 of these had been analyzed to identify their biodynamic chemical components. Since it has been estimated that at least 25% of the active compounds in currently prescribed synthetic drugs were first identified in plant sources (25), the investigation of phytochemicals and their potential healing qualities will be increasingly important in the future.

Several plants contain biodynamic ingredients that have been verified as medicinally beneficial through repeated field/clinical testing and laboratory analyses. The following are some of the best known and most widely used examples: 1) Willow tree (*Salix caroliniana* and related species)—possesses acetylsalicylic acid, a major component of aspirin; 2) Poppy flower (*Papaver somniferum*)—a source of opium, morphine and codeine; 3) Foxglove plant (*Digitalis latana*)—contains digoxin, a heart medicine; 4) Cinchona tree (*Cinchona officinalis*)—anti-malarial drug quinine is extracted from the bark; 5) Dogbane plant (*Rauwolfia serpentina*)—anti-hypertensive, tranquilizing drug reserpine obtained from the bark; 6) Pacific yew tree (*Taxus brevifolia*)—anti-cancer drug taxol extracted from the bark; 7) Periwinkle flower (*Catharanthus roseus*)—source of anti-cancer drugs vinblastine and vincristine; 8) Aloe plant (*Aloe vera* and related species)—source of aloin used in dermatologic and other topical medicines; 9) Saw palmetto berries (*Serenoa repens*)—contain sterols and fatty acids

proven beneficial for prostate gland disorders; 10) Garlic (*Allium sativum*)—clinical evidence indicating immunity-enhancing, blood pressure-reducing, and cholesterol-lowering effects (26–29).

A growing list of additional plants with purported therapeutic qualities await further scientific investigation to confirm their bioavailability, physiological effects, and potential healing efficacy: Black Cohosh (*Cimicifuga racemosa*), Camphor (*Cinnamomum camphora*), Echinacea (*Echinacea angustifolia*), Ephedra/“Ma Huang” (*Ephedra sinica*), Feverfew (*Tanacetum parthenium*), Ginger (*Zingiber officinale*), Ginkgo (*Ginkgo biloba*), Ginseng (*Panax ginseng*), Goldenseal (*Hydrastis canadensis*), Hawaiian Noni (*Morinda citrifolia*), Hawthorn (*Crataegus laeviagata*; *C. monogyna*), Lignum vitae (*Guaiaacum officinale*), Milk Thistle (*Silybum marianum*), Peppermint (*Mentha piperita*), St. John’s Wort (*Hypericum perforatum*), Senna (*Cassia angustifolia*), Valerian (*Valeriana officinalis*), and Yarrow (*Achillea millefolium*) (30–34).

The potential applications and possible side effects of botanical medications are now being intensively investigated on a number of research fronts. Various types of data are being collected, processed, and compiled through double-blind clinical trials, biochemical assays of specimens, analyses of informant interviews and anecdotal reports, and the observation of traditional herbalists and their diagnostic and herbal preparation procedures in different cultures. This work is now yielding an ever-increasing stockpile of cross-cultural evidence for future comparative research (35–37).

A long history of trial and error has led to the correlation of particular herbs with the amelioration and/or complete curing of certain diseases. The physical characteristics of the plants, including size, shape, color, texture, and taste have traditionally served as important criteria in their selection for therapeutic purposes. The choice of yellow plants such as Dandelions (*Taraxacum officinale*) for jaundice and urinary conditions, the heart-shaped leaves and red flowers of Heart’s Ease (*Viola tricolor*) for cardiac disorders and blood diseases, and “scaly” plant parts such as pine cones (*Pinus mugo*) for dermatological conditions represents a component of a folk healing system called the “Doctrine of Signatures” ascribed to various medical traditions ranging from American Indian to ancient Chinese. The plants’ physical traits are thus interpreted as providing clues or “signatures” to their appropriate medical value. Vernacular (common) names of many other medicinal herbs have likewise been traced to these pre-scientific associations as well, such as Feverfew (*Tanacetum parthenium*), Liverwort (also called Liver Leaf—*Anemone hepatica*), Self-Heal (also called Heal-all and Woundwort—*Prunella vulgaris*), Toothwort (*Dentaria diphylla*), Boneset (*Eupatorium perfoliatum*), and Eyebright (*Euphrasia rostkoviana*). By the same token,

extracts of the Impatiens flower (*Impatiens glandulifera*) have been prescribed in the treatment of nervous disorders (38; 39, p. 17–18).

Virtually all plant parts have been tested and prescribed for their therapeutic value: roots, stalks, stems, pods, seeds, leaves, berries, entire flowers, petals, buds, shoots, rhizomes, pollen, twigs, branches, vines, barks, thorns, saps, resins, gums, fruits, juices, etc. (40–42). Some wild species of medicinal plants or their parts are consumed directly without modification. In most cases, however, there are specific preparation procedures, beginning with the careful sowing, fertilization, watering, tending, cultivation, and harvesting of each individual species.

Herbalists in different cultures have historically played close attention to their target plants’ habitats and micro-environments, including latitude and longitude, soil quality, exposure to sun and rainfall, amount of shade, wind characteristics, temperature variations, animal and insect activity, and pollution level. Particular methods are characteristically employed to collect, process, store, and preserve the resulting botanical products (43–46).

Several techniques are used by traditional herbalists to obtain the beneficial phytochemical components from the selected species. By far the most common method cross-culturally is boiling, either in water or a specially designated mixture of liquefied materials, to produce a safe and digestible plant-based medication. Heating a raw plant in a fluid medium not only aids the extraction and concentration of curative substances, it also acts to eliminate poisons and impurities prior to consumption (47–50). Nevertheless, there are hundreds of plants that are potentially poisonous for humans and numerous deaths have been documented following their accidental or unregulated intake (51, 52).

The various routes of administration of herbal medications are typically chosen according to both the consistency of the preparation and the disease or condition under treatment. The majority of botanically-based remedies are consumed orally in the form of a tea or other drink containing either diluted or concentrated chemical ingredients. The teas are generally produced by one of two related methods. In the process of “infusion,” boiling water/liquid is poured over a particular quantity of finely cut or chopped leaves, stems, flowers, roots, or fruits for several minutes. “Decoction” involves the prolonged and more thorough boiling and soaking (“steeping”) of harder plant parts such as branches, twigs, bark, seeds, uncut roots, or the entire compacted plant. In each case the resulting liquefied mixture is strained and cooled. Both procedures allow for the release and recovery of the plants’ water-soluble medicinal constituents (37, 53, 54).

Plant extracts are also processed or refined to produce therapeutic tinctures, syrups, sauces, oral sprays, tablets, encapsulated powders, snuffs, and sublingual lozenges.

Tonics and potions are taken on a regular basis in numerous cultures for general preventive medicine, enhanced disease resistance/immunity, rejuvenation, and as a “booster” for rapid recovery following an illness or injury. Other methods of ingestion of botanical products include the inhalation of aerosols, aromatic oils, and vaporized plant juices or teas, as well as absorption via rectal or vaginal suppositories. Solid materials such as barks, gums, berries, roots, etc., are also chewed to obtain healing components (43, 55, 56).

Organic plant matter is also attached externally in cultures worldwide. In making a poultice, for example, herbs are ground or crushed and combined with hot water or other liquid plus a suspension vehicle, such as flour or corn meal, to create a medicinal paste or plaster. The resulting mixture is placed directly on cuts, wounds, bruises, sprains, arthritic joints, strains, burns (including sunburn), insect and animal bites, dislocations, rashes, swellings, wrinkles, and other painful injuries or dermatological irritations. For these and other integumental problems, plants have also traditionally yielded therapeutic raw materials for hygienic creams, salves, balms, lotions, powders, ointments, lubricants, emollients, oils, dressings, cleansers, etc., and such items are commercially available as well in most countries today (35, 44, 45).

The dispensing practices of herbalists and their recommended dosages of botanical medicaments vary by culture and individual healing professionals. Intake schedules for particular herbal remedies are designated according to chronological variables such as time of day or month, associated physical activities such as before sleeping or after exercise, and developmental milestones such as during pregnancy or after menopause. Pharmacological licensing and/or credentials may or may not be required in order to perform such services. In many Caribbean societies, for example, healers and herbal specialists acquire their positions through inheritance (“transmission”) since it is believed that these skills and abilities are passed down through family lines by way of birthrights and visions rather than lengthy training and apprenticeship (35, 43). Laguerre (57, p. 42) says the following about traditional Caribbean healers: “Healers may be the third, second, or even the first generation in a family, including those who have not been formally educated but have simply received their knowledge in a dream or through the mediums of spirit possession....The process of transmitting knowledge from one generation to the next is a complex one, and the end result is not always identical.”

In many traditional healing systems herbal medications are classified according to their actual or potential biodynamic effects on the body. For example, stimulants such as Cayenne Pepper (*Capsicum frutescens*) and Tobacco (*Nicotiana tabacum*) have been prescribed to increase blood flow and raise energy level. Diuretics such as the Juniper fruit

(*Juniperus communis*) and Watercress (*Nasturtium officinale*) have been recommended to promote urination and thus expel toxins. Expectorants help to remove mucous accumulation and include products of the Soapwort plant (*Saponaria officinalis*) and the Sweet Violet flower (*Viola odorata*). Extracts of the Australian Tea Tree (*Melaleuca alternifolia*) and the Elecampane flower (*Imula helenium*) have been prescribed for many years as antibiotics. Topical antiseptic cleansers known as astringents have historically been distilled from the Witch Hazel plant (*Hamamelis virginiana*) and Oregano (*Origanum vulgare*). Preparations from the German Chamomile flower (*Matricaria recutita*) and French and English Lavender flowers (*Lavandula angustifolia*; *L. dentate*) have been employed as sedatives and tranquilizers. Tonics created for general strength-building and disease prevention have been derived from the root of the Yellow Gentian (*Gentiana lutea*) and the dried whole Buckbean (Bog Bean) plant (*Menyanthes trifoliata*) in several different cultures found in northern temperate zones. Natural analgesics and anesthetics have been produced from a variety of species including the Mandrake root (*Mandragora officinarum*) and Wintergreen oil (*Gaultheria procumbens*). Purgatives have historically been obtained from the seeds of both the Castor Oil tree (*Ricinus communis*) and the Psyllium plant (*Plantago psyllium*). Diabetes has been managed by traditional healers with Cerasee (*Momordica charantia*) and Eucalyptus (*Eucalyptus globus*). Herbalists have frequently recommended digestive aids such as dried leaves of the Fennel plant (*Foeniculum vulgare*) and seeds of the Anise spice (*Pimpinella anisum*), and laxatives have been produced from different parts of the Papaya fruit (*Carica papaya*). Products obtained from the Autumn Crocus flower (*Colchicum autumnale*) have been used in many countries since ancient times to lower the body's uric acid levels in the treatment of gout. In many healing systems dentists have used Bloodroot (*Sanguinaria canadensis*) and several plants containing the colorless aromatic oil eugenol (C₁₀H₁₂O₂) in the form of toothpastes, powders, mouthwashes, and other agents promoting oral health. From a cross-cultural and historical standpoint, two of the most frequently prescribed ethnomedicines for psychiatric disorders are *Banisteriopsis inebrians* (“Ayahuasca” or “Visionary Vine”) and *Cannabis sativa* (“Hemp”), both of which are brewed into a tea or smoked to induce euphoria, mental stimulation, or other types of psychological benefits (43, 44, 58–61).

Anthropological research in a substantial number of societies has revealed the longstanding custom of birth control and fertility regulation through the use of medicinal plants. While some species have been exploited for their purported ability to enhance sexual potency, others have been applied toward reducing the opportunity for fertilization through their inhibiting phytochemical

TABLE 1. Plants prescribed for fertility-related applications in the Caribbean*

Species	Preparation	Applications
<i>Aloe barbadensis</i>	Leaf decoction	Emmenagogue, Menstrual regulator, Childbirth aid, V.D. treatment
<i>Aloe vera</i>	Leaf decoction	Abortifacient, Emmenagogue
<i>Ambrosia hispida</i>	Leaf infusion	Emmenagogue, Childbirth aid, Menstrual regulator
<i>Argemone mexicana</i>	Stem decoction	Emmenagogue
<i>Arthemisia absinthium</i>	Leaf decoction	Abortifacient, Emmenagogue
<i>Bryophyllum pinnatum</i>	Leaf infusion	Anti-gonorrheal, Dysmenorrhea
<i>Carica papaya</i>	Fruit, Leaf decoction	Lactation stimulant, Abortifacient, V.D. treatment
<i>Casearia ilicifolia</i>	Leaf decoction	Abortifacient, Emmenagogue
<i>Cassytha filiformis</i>	Plant decoction	Sex stimulant, Aphrodisiac
<i>Eleutherine bulbosa</i>	Bulb decoction	Abortifacient
<i>Eryngium foetidum</i>	Plant decoction	V.D. treatment
<i>Fevillea cordifolia</i>	Stem decoction	Abortifacient
<i>Gnaphalium viscosum</i>	Flower decoction	Abortifacient, Emmenagogue
<i>Gossypium barbadense</i>	Root decoction	Abortifacient, Uterine stimulant
<i>Guaiacum officinale</i>	Plant, Leaf decoction	Abortifacient, Emmenagogue
<i>Haematoxylon campechianum</i>	Plant decoction	Abortifacient
<i>Hamelia patens</i>	Plant, Leaf decoction	Abortifacient
<i>Ipomoea pescaprae</i>	Leaf decoction	Pregnancy aid
<i>Leonotis nepetaefolia</i>	Leaf, Stem decoction	Abortifacient, Emmenagogue
<i>Momordica charantia</i>	Plant decoction	Abortifacient
<i>Nepeta cataria</i>	Leaf infusion	Menstrual regulator, Aphrodisiac, Emmenagogue
<i>Pterocarpus officinalis</i>	Bark, Wood decoction	Abortifacient
<i>Rhoeo spathacea</i>	Leaf infusion	Abortifacient, Anti-gonorrheal
<i>Rhytidophyllum auriculatum</i>	Leaf decoction	Abortifacient
<i>Rivinia humilis</i>	Plant decoction	Anti-gonorrheal
<i>Ruta chalepensis</i>	Plant decoction	Emmenagogue
<i>Stemodia durantifolia</i>	Plant decoction	Emmenagogue
<i>Tabebuia bahamensis</i>	Leaf decoction	Sex stimulant, Aphrodisiac
<i>Tabebuia heterophylla</i>	Leaf decoction	Anti-gonorrheal
<i>Tetragastris balsamifera</i>	Bark decoction	Aphrodisiac
<i>Tournefortia bicolor</i> ; <i>T. hirsutissima</i>	Leaf infusion	Abortifacient, Emmenagogue
<i>Turnera ulmifolia</i>	Leaf decoction	Menstrual regulator, Abortifacient, Emmenagogue

*Data from Halberstein (35, 43) and Weniger, et al. (62).

effects upon the reproductive systems of both men and women. Field studies in Brazil and Paraguay, for example, resulted in the identification of 35 and 38 plant species, respectively for contraception and other fertility-related indications. While the chemical actions and physiological effects of these plants remain unclear, informant reports indicate consistent success with their employment (62–66). Several herbal preparations have traditionally been prescribed in different cultures as abortifacients. Kay (67, p. 275–276) documents the ongoing use of a number of these in Mexican and North American Indian populations. The author identifies three pharmacologically active phytochemicals which have delivered positive results for that purpose—aborine, furanoquinoline, and thujone. Table 1 lists a number of plant species that have traditionally been prescribed by herbalists in the Caribbean for fertility-related issues.

The use of botanical products in the treatment and prevention of hypertension is also well-documented. Surveys conducted in the Caribbean over the past century

indicate that high blood pressure is an endemic public health problem there (46). Since synthetic drugs have only relatively recently been introduced on a large scale in the region, the indigenous populations have relied mainly upon ethnomedical treatments including local botanical resources. Field research in several Caribbean countries has revealed the regular intake of numerous herbal teas and other brews reported to reduce blood pressure. Biochemical assays of these concoctions have disclosed the presence of anti-hypertensive chemical components whose bioavailability is activated during boiling and other medicinal preparation procedures (35, 43, 44, 68). The following biodynamic constituents have been found in measurable quantities in the 16 most frequently prescribed medicinal plants for hypertension in the Caribbean: reserpine, alstonine, quercetin, rutin, linoleic acid, gamma-aminobutyric acid, and methanol (69). All these substances possess verified anti-hypertensive properties in the human body and are classified as vasodilators, diuretics, electrocardiac modifiers, nervous system depressants, and antiadrenergics.

TABLE 2. Medicinal plants used to treat high blood pressure in the Caribbean*

Species	Preparation	Geographic distribution
1. <i>Ambrosia hispida</i>	Leaf infusion	Cuba, Dominica, Turks and Caicos
2. <i>Argemone mexicana</i>	Plant decoction	Jamaica, Bahamas, Turks and Caicos
3. <i>Artocarpus altilis</i> ; <i>Artocarpus communis</i>	Leaf infusion	Trinidad, Bahamas, Jamaica, Guyana, St. Kitts, Martinique
4. <i>Bryophyllum pinnatum</i>	Leaf infusion	St. Kitts, Trinidad, Turks and Caicos, Bahamas
5. <i>Bursera simaruba</i>	Bark and Root decoction, Leaf infusion	Bahamas, Jamaica
6. <i>Carica papaya</i>	Fruit decoction, Leaf infusion, Juice ingestion	Bermuda, Curacao, St. Kitts, Trinidad
7. <i>Catharanthus roseus</i>	Plant decoction	Bahamas, Guadeloupe, Curacao, Trinidad, Tobago, St. Kitts, Martinique
8. <i>Citrus aurantifolia</i> ; <i>Citrus aurantium</i>	Leaf infusion	Bahamas, Curacao
9. <i>Cordia cylindrostachya</i>	Leaf infusion	Guyana
10. <i>Guaiacum officinale</i>	Leaf infusion, Fruit juice ingestion	Bahamas; Guadeloupe; Curacao; Turks and Caicos
11. <i>Mangifera indica</i>	Leaf infusion	Curacao; Trinidad; Tobago
12. <i>Melicoccus bijugatus</i>	Leaf infusion	Bahamas
13. <i>Momordica charantia</i>	Plant decoction, Leaf infusion	Aruba; Curacao; St. Kitts; Trinidad; Martinique
14. <i>Rivina humilis</i>	Plant decoction	Turks and Caicos

*Data from Halberstein (69, 70).

Many of these compounds are now contained in synthetic commercially-produced blood pressure medications. Hypotension (low blood pressure) has also traditionally been treated with medicinal plants in the Caribbean, including teas made from leaves of the chocolate tree (*Theobroma cacao*) and the aromatic evergreen shrub (*Rosmarinus officinalis*) (68–70). The most frequently used anti-hypertensive medicinal plants in the Caribbean are listed in Table 2.

The recent chapter by Mills (71) serves as a useful guide to clinically tested herbal drugs. Two topical volumes by J. A. Duke comprehensively summarize our exponentially expanding knowledge of phytochemical actions and applications (72, 73). These publications clearly indicate the direction of future research on medicinal plants—the rigorous scientific evaluation of medicinal plant products and their potential effects on the human body and health.

Since there is no sharp dividing line separating food and drug, it is not surprising that various edible plants have been sources of both nutrition and medicine in different cultures. Thus, the nuts from the Almond tree (*Prunus amygdalus*) could be considered as either a meal or a possible cancer preventive. Cranberry juice (*Vaccinium macrocarpon*) is a refreshing drink in some societies and a powerful renal/urinary tract treatment in others. The health benefits of red wine have likewise been touted in numerous cultures for centuries (74, 75). A wide assortment of food additives derived from vegetation, including flavorings, seasonings, condiments, and appetizers also have purported medicinal qualities. A number of species of mints (e.g., *Mentha piperita*) and spices (e.g., Allspice—*Pimenta dioica*), for example, have served the dual purpose of garnishing and healing (76, 77).

Already acclaimed for their role in prophylactic disease prevention, the elemental nutrient contents of various foods—vitamins, minerals, proteins, etc.—have also been isolated and tested for their possible medical value with positive results. Calcium supplements have been prescribed for osteoporosis in adults, various forms of iron have proven beneficial for anemia, and protein pills have been recommended to help reverse the effects of growth retardation in children (78, 79). A recent series of clinical trials demonstrated that high dosages of ascorbic acid (vitamin C) significantly promoted rapid healing following dental extractions. Long known as a preventive against scurvy and gum disease, ascorbic acid (C₆O₈C₆) also acts as an important catalyst in several physiological processes involved in socket repair and healing after the loss or removal of a tooth (80–83).

ORIGINAL DATA: CARIBBEAN-AMERICANS IN MIAMI, FL

The ancient custom of medicinal plant usage continues to be adaptive today in many populations and is gaining popularity in others. A recent field study of a sample of 290 Caribbean-born adults aged 28 to 85 years living permanently in Miami, FL delineated that nearly two-thirds (65.2%) reported the regular intake of traditional herbal remedies (84). A wide selection of medicinal plants are readily available in Miami—a survey published in 1992 counted 57 “botanicas” (medicinal herb shops) within the city limits (85), and a follow-up analysis of the same geographic area by the present author in 2004–2005 indicates that the number of such establishments has grown

to 89, an increase of 56% (this study). The proprietors claimed the healing regimens found there deliver therapeutic benefits for physical disorders ranging from flatulence (Caraway seeds—*Carum carvi*) and dandruff (Marigold oil—*Calendula officinalis*) to cancer (Angelica roots—*Angelica archangelica*), diabetes (“Brazilian stick” aka “Palo de Brasil”—*Haematoxylum brasiletto*), and AIDS (Mistletoe branches and leaves—*Viscum album*), as well as a broad spectrum of psychological problems. While certain species are recommended and sold to relieve pain, none were available in any of the stores specifically for arthritis.

The healers on duty handle both acute and chronic conditions. Diagnoses and prescriptions are available on the premises on a walk-in basis. All the healers and other employees said they had received extensive personal training on an individual basis from established professionals in the field. They indicated that they obtained their products from special nurseries or their own personal garden plots. In some cases seeds or plants were imported from other U.S. cities or foreign countries.

Other applications of the herbs available in the Miami *botanicas* include their use in religious worship, in potions for spells to protect against evil forces, to bring good luck, and as part of spiritual cleansing. The stores also serve as outlets for a variety of religious artifacts and paraphernalia including charms and amulets, special clothing and regalia, literature, art objects, small musical instruments, dolls/statues and effigies, and other indispensable items necessary for rituals as well as the maintenance of health and spiritual balance. Sacrificial animals can be provided upon request. Interviewees agreed that *botanicas* also offer spiritual advice and consultation, and they function as important social network centers where clients and the general public can meet and “connect” to discuss religious issues and health-related matters.

A parallel example of ongoing interest in botanical health resources co-existing alongside the rapid development of modern biomedicine was observed in urban Puerto Rico. An investigation of 802 subjects visiting out-patient clinics of five health centers recorded 57% as regularly using medicinal plants. They were most commonly taken for gastro-intestinal conditions, elevated blood pressure, sleep disorders, kidney diseases, and respiratory ailments. The single most frequently used plant was *Citrus aurantium* (Bitter/Sour Orange)—39% of respondents indicated its use for various therapeutic purposes (86).

PROSPECTS FOR THE FUTURE

Renewed interest in complementary and alternative medicine (CAM) in the U.S. and elsewhere has stimulated increased awareness and experimentation with legendary

herbal remedies. A larger percentage of Americans are purchasing and exploring the applications of medicinal plants than ever before. Dissatisfaction with the high costs and potentially hazardous side effects of factory-made pharmaceuticals has been partly responsible for this trend (87, 88). On the same page of a recent book, Freeman (89, p. 439) makes the seemingly paradoxical, but nevertheless true, statements that “Herbal medicines are the fastest growing category of alternative therapies in the United States” and “Physical evidence of the use of herbal remedies dates back approximately 60,000 years, and more than one quarter of prescription medicines have been developed from herbs.”

Additional research emphasis in the field of medicinal plants is required in the future on issues of safety, toxicity, proper dosages, contamination, and potential interactions with synthetic and other natural drugs. Recent deaths attributed to the recreational use of species of *Ephedra* and reports of poisonings caused by an herbal diabetes remedy have resulted in stricter regulations established by the U.S. Food and Drug Administration (90, p. 214). Another well-documented example is the large number of deaths and injuries resulting from the overdose of extracts of Coca leaves (*Erythroxylon coca*). These events underscore the need for more intensive investigations of the physiological and psychological effects of botanical medicaments. To further reduce the possibility of human poisonings, methods might also be developed to neutralize the phytotoxins, often considered to function as the protective chemical “defense mechanisms” of a plant which repel animal species and thus enhance its survival. Ongoing research is now focusing upon the possible hazards of herb-synthetic drug interactions and new procedures to compress and energize natural plant materials. One goal of this work is to design more powerful, faster-acting botanical formulations that in some cases might replace the potentially dangerous or addictive factory-made drugs currently prescribed for severe pain, fiery inflammations, troublesome allergic reactions, etc., (91–93).

In recent years, a number of trends have begun to threaten the world’s phytochemical resource base, including rainforest destruction and associated land “development,” elevated soil and water pollution levels related to the by-products of urbanization, and the over-harvesting of drug plants. Fortunately there is also a counter-trend underway to preserve natural botanical resources through an increasing emphasis on conservation by way of botanical gardens, arboretums, greenhouses, herbariums, tissue cultures, propagation laboratories, and seed banks (90, pp. 200–202).

The discovery of the healing powers of a myriad of plants represents one of the most significant accomplishments in human medical history. This vital, but as yet understudied field still requires a great deal of “catch-up”

work in the future. As Sumner (90, p. 16) points out, "Plants can cause hallucinations, arousal or sedation, heart palpitations, fatal poisoning, or successful healing, depending upon the species and its chemical components." Additional careful research will eventually allow for the accurate sorting and compilation of this immense quantity of useful information.

APPENDIX

The appended bibliography of 202 books on herbal interventions, with publication dates of entries ranging from 1847 to 2005, hopefully establishes a suitable starting point for further investigation. The data found in these works are arranged in different formats. General surveys and catalogs are available for either large geographic regions or specific cultural sub-groups. Some volumes are organized according to particular treatable diseases and other health conditions. Several of the books focus upon clinical applications and chemical constituents, while others could serve as field guides for proper botanical identifications and classifications. Some of the publications deal with topics such as cultivation, preparation procedures, and safety regulations. Religious and ritual uses of medicinal plants are also covered. The majority of the items include historical information.

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