Journal of Evidence-Based Complementary & Alternative Medicine
2017, Vol. 22(3) 494-501

DOI: 10.1177/2156587216671392
journals.sagepub.com/home/cam
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The Significance of Ayurvedic Medicinal Plants

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Abstract

Traditional Indian medicine (ayurveda) is becoming increasingly popular, with many chronic conditions responding to it well. Most patients begin to take conventional medications as soon as their diagnoses are made, so ayurvedic treatments are usually undergone alongside and/or after conventional medical approaches. A detailed knowledge of the action of food, spices, and medicinal plants is needed in order to understand their potential influence fully. While societal use of ayurvedic plants and Indian spices is commonplace, without ill effect, the use of more concentrated products made from single plants, often in the form of teas or tablets, is of more concern. The mechanisms by which polyherbal drugs and their extracts act differ in many respects from the actions of single substances or synthetic drugs. Despite the fact that ayurvedic medicines are based on natural herbal materials, their safety depends on their method of administration, taking into account individuals' needs and their specific disease conditions.

Keywords

ayurvedic polyherbal medicine, action of ayurvedic plants, importance of ayurvedic plants, ayurvedic pharmacology

Received March 4, 2016. Received revised August 26, 2016. Accepted for publication September 1, 2016.

Traditional Indian medicine (or ayurveda) is becoming increasingly popular in Europe, with many chronic conditions responding to it well. While conventional medicine dominates many fields in this market, it does not always outperform traditional ayurvedic approaches. Conventional medicine frequently relies on lifelong medication, on which patients come to depend. Many medications have side-effects, and withdrawal symptoms that, if the medications are later discontinued, can become problematic. In such circumstances, ayurveda has much to offer. Patients generally respond well to ayurvedic treatments, experiencing a reduction, and sometimes even a cessation, of their symptoms. Most patients begin to take conventional medications as soon as their diagnoses are made, so ayurvedic treatments are usually undergone alongside and/or after conventional medical approaches. Patients therefore tend to experience ayurveda once their conditions have progressed. Despite this, much can be done to minimize conditions' symptoms and control their progress. Ayurveda can help improve patients' symptoms by reducing their cortisone and analgesic usage, thereby enhancing their quality of life.

The public constantly seeks out new health care approaches. In this situation, ayurveda is an easy target for bogus health claims. Many of the available books are inauthentic—a product of unqualified authors' ideas and fantasies. Short-term courses similarly vary greatly in the quality of the teaching provided and the qualifications thereby obtained. While ayurveda is becoming increasingly popular, which is a positive development, care must be taken against its mismanagement, especially given the vast array of spurious "ayurvedic" products currently on the market.

Concepts Underpinning Ayurvedic Medicine

Traditional Indian medicine, or ayurveda, is based on a traditional medical system, in the same way as traditional Chinese medicine, with both being developed in their respective geographic regions. Ayurvedic practice is around 3000 years old, with a long history of managing disease. The 3 basic principles, called *doshas* (*vata*, *pitta*, and *kapha*), are derived from 5 elements of Indian philosophy. Ayurveda's *doshas* can be identified as regulatory control factors for fundamental physiologic processes in living systems that maintain their identity throughout biologic history: *vata* and its *subdoshas* regulating input/output processes and motion; *pitta* and its *subdoshas* regulating throughput, turnover, and hence energy; and *kapha* and its *subdoshas* regulating storage, structure, and lubrication.[1]

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Factors such as food, activity, the climate and stress can, however, disrupt or destroy these functions. Ayurveda seeks to normalize body functions with varied techniques including advice on food and activity, internal herbal preparations, purification treatments (*panchakarma*), and surgical methods (*shalya chikitsa*).

Oral administration routes play a major role in influencing individuals' *doshas*, via the ingestion of food, spices, and medicinal plants. These elements are influencing *doshas* in different ways: stabilizing, disturbing, and supporting the body's healthy state. A detailed knowledge of the action of food, spices, and medicinal plants is needed in order in to understand their potential influence fully.

Ayurvedic Medicinal Plants

Ayurveda first seeks to diagnose patients' conditions before treating them with internal preparations, diet, and habit restrictions. Plant-based preparations play a major role in the ayurvedic healing process. In broad terms, there is no substance in the world that cannot be used as a potential medicine.[2] Traditional ayurvedic texts warn against the use of substances that are not adequately understood.[3] Any plant, animal, or mineral substance can be incorporated into the ayurvedic pharmacopeia, but only if it is understood fully, in terms of its nomenclature, identity, properties, and applications.[4] The texts also warn against the abuse of well-known medicines, emphasizing the point that even poisons can have medicinal properties when used appropriately, whereas the best of medicines can be harmful if improperly used.[3] Of nearly 10 000 plants used for medicinal purposes in the Indian subcontinent, only 1200 to 1500 have been incorporated into the official ayurvedic pharmacopeia in more than 3000 years. All plants must be studied thoroughly before becoming part of the ayurvedic pharmacopeia.[3]

Actions of Foods, Spices, and Medicinal Plants

The Role of Food

Food plays a major role in ayurvedic practice by supporting the body's healing processes. Metabolic diseases and diseases of the gastrointestinal tract are directly influenced by food. Food can also indirectly affect diseases of the skin, muscles, and joints, as well as neurological, gynecological, and psychological disease.

Infrequent consumption is unlikely to cause a problem, but frequent consumption of inappropriate foods will cause disease or worsen existing disease. Advice on food depends not only on the disease but also on the disease condition and the *dosha* involved. Because of this, food advice may change throughout the course of a disease, depending on the stage reached. Interactions between foods and medicines are a major issue. The advice given with regard to food must take account of the medicines prescribed, otherwise potential interactions may worsen patients' conditions.

The Action of Indian Spices

The second strongest influence on patients' *doshas*, after food, is spices. Many spices are strong by nature. Spices are obtained from the roots, flowers, fruits, seeds, or bark of plants or herbs. Spices are native to warm, tropical climates. Coming from woody or herbaceous plants, spices have a different active principle, which gives them specific characters. These active principles have specific functions within the body. The phytochemicals within spices are secondary metabolites, which serve to protect the plants from damage by insects, animals, fungi, pathogens, and parasites. Before consumption, most spices are dried to degrade these chemicals. Drying also increases the resulting spices' shelf life and potency.

The action of spices within the body differs according to the ways that they are used. Spices are mostly used for their natural flavor and aroma in processing food. In addition to adding taste, some spices (cumin, ginger, coriander) also have preventative effects, aiding digestion through the production of digestive enzymes. When mixed with digestive juices, these substances aid absorption. Such spices have individual effects, their actions depending on the constitution of the person concerned and their disease. Indian food is becoming increasingly popular and is often seen as healthy. From an ayurvedic perspective, healthy food is food that is used in a healthy way. From this viewpoint, spicy and pungent foods are not necessarily "good" foods. Indian food is not automatically ayurvedic, because the latter insists that individual's health situation be taken into account. People with gastric hyperacidity or gastric or intestinal inflammation may find their health worsened by exposure to some Indian spices.

Ayurvedic Medicinal Plants

Approximately 90% of ayurvedic preparations are plant based. Ayurvedic plants have a stronger action on the body than either food or spices. Such actions enable the plant to reverse pathophysiological processes and stabilize the *doshas*. For this reason, one should use such plants with caution. Classical ayurvedic preparations, made from such plants, are known as "yoga" in Sanskrit. Yogas have developed following years' of practical experience combining plants to get the optimal effect.

Polyherbal combinations have also proven lastingly effective than single herbs. In ayurveda, most of the classical preparations are polyherbal, with a combination of 3 to 30 plants involved. These constituents are combined accurately, in such a way that the formula is balanced and reproducible. One or two of the plants in these combinations will be active and the others will play a supporting role. The supporting herbs will each have different actions, acting as catalysts to help proper absorption, transportation, and to reduce toxicity. If an ideal combination is delivered, then the result can be excellent, but such outcomes are based on thorough plant knowledge (see Figure 1).

Ayurvedic Plants: Misuse and Self-Medication

While societal use of ayurvedic plants and Indian spices is commonplace, without ill effect, the use of more concentrated products made from single plants, often in the form of teas or tablets, is of more concern. Ayurvedic plants are generally seen

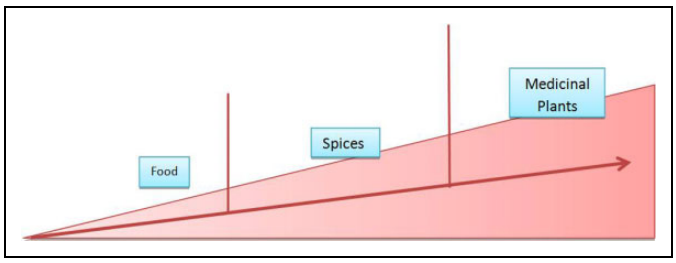

Figure 1. Concept of the increasingly intense influence of food, spices, and medicinal plants on the body.

as safe and free from side effects, which is not always true. Table 1 lists some undesirable effects of improper use of ayurvedic herbs. Some of the common plants sold in the market are *tulsi* (Figure 2), *guduchi* (Figure 3), and *pippali* (Figure 4).

Ayurveda Branding as Teas

Classified as *vata*, *pitta*, or *kapha* teas, these products are marketed for their supposed beneficial effects on individuals' corresponding *dosha* problems. From an ayurvedic perspective, diseases certainly seem to arise from the improper function of these 3 *doshas*. Ancient texts list 80 *vata* diseases, 40 *pitta* diseases, and 20 *kapha* diseases. The more recent recognition of new diseases should make this number even higher. The complex pathophysiology of modern disease means that the symptoms that individuals experience are always a combination of 2 or 3 *doshas*. This complexity means that ayurvedic preparations must be equally complex. In the classics, 63 major combinations of *doshas* have been listed and this complexity needs to be considered to elicit therapeutic effects. For example, migraine, low back pain, or arthritis of the knee can occur from *vata* imbalance. These diseases have different pathophysiological mechanisms, manifesting themselves in different body regions. To treat these conditions, drugs that act on the selected region are chosen. Compounds made from groups of plants are then combined in prescribed ways to achieve the desired effects. This means that undifferentiated concepts of *vata*-, *pitta*-, and *kapha*-related teas are nonsensical. Most of the above-mentioned teas contain a variety of nonspecific, commonly used, spices. While these teas can certainly be consumed for refreshment purposes, they will not cure disease.

The Rationale for Ayurvedic Formulations and Actions

Ayurvedic products are mainly composed of herbal combinations.[16] In certain parts of India, ayurvedic formulations also contain heavy metals. Traditional texts such as *Charaka Samhitha*, *Susrutha Samhitha*, and *Ashtanga Samgraha* do not describe the use of heavy metals—clearly this is a later development. Heavy metals are toxic and are not permitted at any level in modern pharmaceuticals. By contrast, in ayurvedic preparations, metals may be added for their perceived therapeutic effects to form *rasausadhies* (herbo-bio-mineral metallic preparations). In ayurveda, the use of metals and minerals as medicines have been recommended only after purification (*shodhana*) and that with recommended low dose, with specific vehicle (*anupana*), for a particular period and obeying dos and donts in relation to diet, activities, and environment. Ayurveda has also described the toxic effect, complications, and diseases caused due to ingestion of raw or improperly processed metallic preparations. Researches have revealed the metal content in a number of ayurvedic *rasausadhies* and toxicity cases due to ayurvedic herbal consumptions have been reported throughout the last decade, especially those sold through the Internet.[17] Such metals are not found in pure herbal ayurvedic preparations.[18]

Traditional ayurvedic texts note that quality-assured ayurvedic compounds are strong and potent enough to combat disease. The parts of the plants chosen for use are also important. Depending on the plants concerned, and the medical combinations involved, the leaves, flowers, seeds, bark, roots, or skin of the plant may be chosen. The particular combination chosen results from extensive practical experience of the constituents needed to achieve the maximal effect. The mechanisms by which polyherbal drugs and their extracts act differ in many respects from the actions of single substances or synthetic drugs.[19,20]

Polyherbalism has its roots in the earliest texts of ayurveda like *Caraka Samhita*, *Susrutha Samhitha*, *Ashtanga Hrudaya*, which systematizes the pharmaceutical procedures. The traditional Ayurvedic text *Sarangdhar Samhita*, which dates from 1300 AD, highlights the concept of polyherbalism in this ancient medical system.[21] Most ayurvedic formulations are polyherbal.[22,23] While the active phytochemical constituents of individual plants are well established, they are usually present only in minute amounts and are, thus, insufficient to achieve the desired therapeutic effects.[18] Recent research shows that combining plants of varying potency enhances their effect, both when compared to individual plant use and also to the sum of their individual effect. This phenomenon is known as synergy. Some pharmacological actions, from the active constituents of some herbs, have proven to be significant only when potentiated by those of other plants, but are not evident when used alone.[18] Two mechanisms have been proposed for these actions: pharmacokinetic synergy and pharmacodynamic synergy.[24] The former is based on herbs' perceived ability to facilitate the absorption, distribution, metabolism, and elimination of other herbs. The latter concerns the synergistic effect of active constituents with similar therapeutic actions targeting similar receptors or physiological systems. Most diseases are caused by a multiplicity of factors, leading to both visible and invisible symptoms. A combination of herbs may act on multiple targets at the same time to provide thorough relief.[25]

There is a misconception that ayurvedic preparations, being natural, are always safe. This is untrue. *Charaka Samhita* notes that ayurvedic medicines have adverse effects when prepared and/or used inappropriately.[26] Ayurvedic Pharmacopoeia of India sets standards of drugs/ingredients mentioned in different

Table 1. Effects and Side Effects of Commonly Propagated Ayurvedic Herbs in the Market.

Herbs/Plants	Ayurvedic Perspective	Results of Improper Usage
Curcuma/turmeric	• Anti-inflammatory and anticarcinogenic actions[5-7] • Pungent and bitter in taste (*katu*, *tikta*), dry in quality (*guna*), hot in potency (*veerya*), and pungent in its postdigestive taste (*vipaka*). It is used in vitiated states of *kapha* and *pitta*.	• It dries out patients' stools. • Not to be given in *vata* conditions, with overuse drying out the body and intestine, leading to constipation. • Very high doses of oleoresin of Curcuma, given over 3 to 4 months, shows a dose-dependent increase in the weight of recipients' liver and thyroid glands, as well as epithelial changes in their bladders and kidneys.[8] • Contraindicated in patients with thrombocytopenia, platelet disorders, and gallstones and those receiving aspirin and warfarin.[8] • High doses or prolonged use can cause digestive problems, including stomach irritation, heartburn, nausea, or diarrhea; even ulcers. • Can also make gallbladder problems worse, especially in conditions like bile duct obstruction and gallstone disease. • Slows blood clotting, increasing the risk of bruising and bleeding in people with bleeding disorders. • Spices contain many chemically active compounds. Most owe their flavoring properties to volatile oils, and some to fixed oils and small amount of resin, known as oleoresins. Spices' flavor is due to a blend of compounds, including alcohols, phenols, esters, terpenes, organic acids, resins, alkaloids, and sulfur-containing compounds, in various proportions.[9] In addition to these flavoring components, each spice contains components such as proteins, carbohydrates, fiber, minerals, tannins, and polyphenols. Some of the phytochemicals in commonly used spices are toxic to humans, unless the spices concerned are first dried under shade or sun. Drying serves to evaporate volatile phytochemicals. • Turmeric should not be used in raw form, for this reason. It has been found to control a variety of agricultural and animal pests—its bioactive constituents interfering with insect behavior and growth. Products containing turmeric have also been found useful as insect repellents and insecticides.[10]
Ginger	• Pungent taste, be light and unctuous in quality, hot in potency and sweet postdigestion; help reduce patients' *kapha* and *vata* and increases their *pitta*.	• People who take ginger regularly, in *pitta* condition, or having *pitta prakruti*, may develop *pitta*-related problems. This may, in turn, lead to inflammatory skin problems or to gastrointestinal diseases such as hyperacidity, intestinal inflammation, hemorrhoids. Long-term use may also cause constipation. • It can also interact with anti-inflammatory medications like ibuprofen as well as anticoagulants such as aspirin, warfarin, and heparin.[8] Side effects include increased bleeding, as well as the development of rashes, itching, and swelling of the tongue, lips, and/or throat.
Aloe vera	• Bitter and a sweet taste, a heavy, unctuous and slimy quality, a cold potency, and a pungent postdigestive taste. It is good in vitiated conditions of *pitta* and *vata*. Used in various inflammatory diseases, as well as in skin and liver disease.	• Improper use may cause complications, producing problems arising from *kapha* and *ama* (metabolic toxins). • Long-term use of the latex form of *Aloe vera* can result in potassium deficiency.[8] • It should not be taken orally in inflammatory intestinal diseases like Crohn's disease, ulcerative colitis, or appendicitis, nor used during pregnancy. • Oral ingestion has been shown to be unsafe, especially at high doses, with evidence that some of its constituents may be carcinogenic. • Latex form, can also harm the kidneys, potentially causing serious kidney disease and even death.[11] • The US Food and Drug Administration became concerned about the safety of *Aloe vera* latex, which was an ingredient in many laxative products.[11]
Tulsi (*Ocimum sanctum*), Figure 2	• Taste both pungent and bitter • Light and dry in quality, hot in potency, and pungent in its postdigestive taste. • Increases *pitta* and decreases both *kapha* and *vata*. • Administered against worms and parasites, insect poisoning, and in cases of toxicity.	• Improper and excessive use may aggravate *pitta*, causing *pitta*- and blood-related disorders. • Its marked antifertility action makes its prolonged use in male and female sterility contraindicated. For example, an extract of fresh tulsi leaves, containing benzene, fed to male rats reduced their total sperm count, sperm motility, and the weight of their testes.[12] • A 3-month program of feeding tulsi leaves (200 and 400 mg/kg) to adult male and female albino rats, along with a normal diet, decreased the former's sperm count, sperm motility, and the weight of their reproductive organs.[13] • Among the 7 tissues (*dhatus*) mentioned in ayurveda, reproductive tissue is noted as the last, with a direct relation with *ojus*. *Ojus* relates to the body's immunity, arising from the strength of all the body tissues, especially the *sukra* (male or female reproductive tissue). A plant that affects the *sukra* will also affect the *ojus*, depleting the body's immunity.

(continued)

Table 1. (continued)

Herbs/Plants	Ayurvedic Perspective	Results of Improper Usage
Moringa (*Moringa oleifera*)	• Moringa is mostly grown in the south of India, where its fruits and leaves are used as a vegetable. • Ayurveda uses the plants' roots and bark for medicinal purposes. It is sweet and bitter in taste, sharp and light in quality, hot in potency, and pungent in postdigestion. It is seen to pacify *kapha.*	• Produces burning sensation due to an increase in *pitta*. Excessive use may cause constipation. • It is not advised in pregnant women, as some studies show an abortifacient effect.[8] • These factors make it generally ill-advised to consume moringa regularly, or in large doses.
Guduchi/Amrut (*Tinospora cordifolia*), Figure 3	• It has a bitter taste, is heavy in quality, hot in potency, and sweet in postdigestion. • It pacifies all 3 of the body's *doshas*	• It causes mild constipation in some people. • It increases the force of ventricular contraction, produces bradycardia, and causes a marked but transient fall in blood pressure. • It is also mild diuretic, significantly decreasing blood urea levels in uremic patients.[8]
Pippali (*Piper longum*), Figure 4	• Bioavailability enhancer • It is seen to be sweet and pungent in taste, unctuous in quality, hot in potency, and sweet in postdigestive action. It pacifies *vata* and *kapha*, increases *pitta*, and is slightly laxative. • An immune modulatory plant	• Being misunderstood as a form of pepper • Not used in cooking • Excessive use of pippali creates a burning sensation. • As a *rasayana* treatment, pippali is taken with milk, to reduce its after-effects. • Pippali also has a potent antifertility activity and should not be used in the first trimester of pregnancy.[8]
Aswagandha (*Withania somnifera*)	• Bitter and astringent in taste, light and unctuous in quality, hot in potency, and sweet in postdigestive action. It pacifies *vata* and *kapha*, and increases *pitta*. • Its actions on the central nervous system mean that it is mostly used in patients with mental health conditions.	• Extracts from its roots are known to have both hypnotic and sedative effects, due to the presence of the alkaloid somniferin. • It is contraindicated in pregnancy and in arterial congestion. Large dose may cause diarrhea and vomiting.[8]
Triphala: *Terminalia chebula* (Haritaki), *Terminalia bellirica* (Bibhitaki), *Emblica officinalis* (Amalaki)[14]	• A combination from 3 plants fruit. • It drives out body toxins by unblocking the body's channels (*srothus*).	• Administered during increased body toxins results in symptoms like headaches, rashes, nausea, gastric disturbances, such as flatus and diarrhea, and dehydration. • In people taking blood-thinning medications, and is not advised in conditions like diarrhea or loose or sluggish stools. • Pregnant women and lactating mothers should also consult their doctors before taking or continuing it. • Wrongly prescribed and consumed, *triphala* can cause mucus destruction in the intestines. • Long-term use can also lead to drying of the intestinal flora in some patients. • Assessment of the in vitro effects of *triphala* have shown that these compounds may inhibit the actions of drug metabolizing enzymes.[15]

formulations of Ayurvedic Formulary of India. There are also 56 referral texts described under the Drugs and Cosmetics Act. Apart from these, there have been several other ayurvedic texts written during 1000 BC to 19th century. The numbers of medicinal plants have gradually increased from the Vedic period to modern era inducting more number of indigenous medicinal plants as well as exotic plants. The *Charaka Samhita* stresses the factors to be considered when selecting formulations' constituents, including plants' habitat, the season in which they grow, the prevailing harvesting conditions, the selected method

Figure 2. Tulsi (*Ocimum sanctum*).

Figure 3. Guduchi or amrut (*Tinospora cordifolia*).

Figure 4. Pippali (*Piper longum*).

of storage, and the chosen method of pharmaceutical processing.[27] However, herbs are natural materials, and their constituents may vary due to differing geographical locations, climatic conditions, environmental hazards, harvesting methods, and collection protocols. Such factors make it difficult to standardize or reproduce the quality of the end product.[28]

The concept of bioavailability is broadly defined as the absorption and utilization of a nutrient.[29] The degree and quantity of penetration of a herbal drug, or its active ingredients, is determined by its bioavailability.[30,31] Bioavailability can depend on the chemical complexity of an herb, due to the synergistic and antagonistic actions of its constituents, in promoting absorption. A drug's hydrophobic properties determine its ability to cross the luminal wall, as do the gut microflora, patients' liver function, and the chemical modifications made by the herbal constituents. Herbal drugs must cross the blood-brain barrier if they are to affect the central nervous system, but there is a dearth of literature on Indian herbs, especially ones with potential antioxidant-stimulating properties, on this important topic.[32] The synergistic interactions of herbs can play an important role in their bioavailability. Long pepper, black pepper, and ginger can all increase the bioavailability of some compounds.[33] Person-to-person variation in gut micro flora and hepatic activity also play a role in systemic absorption.[34]

Methods of Drug Administration in Ayurveda

Drug administration methods differ in ayurveda and conventional modern medicine. In the latter, most medications are synthetic; their administration influences the stomach and intestine. Most conventional medications are thus administered after food. Ayurveda has narrated timings of medication according to the patient's nature, disease, and the condition of disease. Ayurvedic preparations are also administered on empty stomach. As the latter preparations are plant-based, they are slow-acting. The absorption of ayurvedic plant preparations occurs as part of normal metabolism. Ayurvedic preparations must be broken down for digestion in the gastrointestinal tract and has to get digested in the stomach and intestine, before getting into blood circulation and before reaching the target organ and bring about treatment action. For ayurvedic physicians, patients' digestive strength is thus important. Ayurvedic preparations must undergo many digestive processes before being absorbed as part of normal metabolism. Ayurvedic physicians therefore analyze their patients' metabolic state before treatment, as a matter of course, aiming for optimal stability and the least gastrointestinal damage.

Ayurvedic medicines exist in different formats, including decoctions, powders, pastes, fermented products, tablets, and medicinal butters (ghees). The formats used, whether liquids, pastes or tablets, are linked to preparations' efficacy. If the format is changed, then the desired effect may be lost and potential side effects created. The parts of the plants used as ingredients are also very important. Sometimes, ayurvedic preparations are administered alongside other natural products,

such as honey, salt, or milk, to get specific actions, according to the disease condition experienced. In Sanskrit, these natural products are termed *Anupana*. These natural products also help minimize any side effects. The timing of ayurveda preparations also varies according to the specific disease and its condition.

Conclusion

From the above discussion, it is clear that many factors must be considered in prescribing or taking ayurvedic medicine. Despite the fact that ayurvedic medicines are based on natural herbal materials, their safety depends on their method of administration, taking account of individuals' needs and their specific disease conditions. The unguided consumption of ayurvedic preparations, in the mistaken belief that spices and herbs will necessarily be safe, may lead to serious health issues. A thorough awareness of these plants' actions is needed for their safe selection and consumption.

Authors' Note

The article was written at the office of Syal Kumar with the guidance of Prof Gustav J. Dobos and Dr Thomas Rampp.

Author Contributions

SK collected the data, references, pictures, and wrote the article. GJD and TR verified the article.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

Ethical Approval

As no human subjects were involved, this study does not require ethical approval.

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