



Herbals and Natural Products: Mechanisms of Action

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ABSTRACT

'Like any other or chemical, the components of herbal medicines are presumed to exert their effects on physiological or biological systems. One major difference is that botanicals contain large numbers of chemicals, which may interact synergistically or antagonistically. Some remedies consist of mixtures of several herbs, so that the number of chemicals in a single preparation can reach into the hundreds or thousands. The most commonly used botanical is Echinacea, Ginseng, Gingko biloba, Garlic, Glucosamine, St. John's wort, Peppermint, Omega-3 fatty acids, Ginger and Soy. This work has a mission on explore the principal properties that demand the mechanism of action of this herbals and naturals products.

Keywords: *Vitex negundo* Linn; Leaves extracts; Phytochemical analysis; Antibacterial activity

INTRODUCTION

Since prehistoric times, humans have used plants as medicines. Over millions of years, plants have developed the capacity to synthesize a diverse array of chemicals, which attract or repel other organisms, serve as photo collectors or protectants, and respond to environmental challenges. With the advent of modern scientific medicine, phytochemicals have been refined, or altered, to produce a share of the modern pharmacopoeia. Despite the increasing availability of many potent and selective drugs, there remains an increasing interest in folk remedies, including herbal medicines. Herbal medicine is the most commonly used form of alternative medicine. Alternative medicine refers to those practices other than the conventional medicine practice. The reasons for such common use of alternative therapies are varied. These include dissatisfaction with conventional medicine, the view that alternative therapies are empowering because of more patient control, and the perception that alternative therapies are more compatible with personal values or ethical beliefs. Predictors for use of alternative therapies include a higher educational level, poorer health status, holistic orientation to health, having had a transformational experience changing one's world view, and having a chronic health condition such as diabetes, chronic pain, or cancer that has not responded to conventional treatment [1]. The biologically-based alternative therapies include the use of botanicals and supplements, often referred to as nutraceuticals, a term coined in 1989 that refers to any substance considered "a food or part of a food that provides medical or health benefits, including the prevention and/or treatment of a disease". Labelling of products containing herbal or botanical ingredients must state the part of the plant from which the ingredient is derived. Botanicals may obtain in many formulations as bulk herbs, oils,

essentials oils, tablets or capsules, teas, infusions, decoctions, tinctures, poultices or plasters. To use these products, manufactures must have substantiation that the statements are truthful and not misleading.

LITERATURE REVIEW

Antioxidant Effects

Oxidation of Deoxyribonucleic Acid (DNA), proteins, carbohydrates, and lipids by reactive oxygen species has been implicated in normal aging and several different diseases, including arthritis, cancer, and Alzheimer's disease. Oxidative stress occurs when there is an imbalance between free radical generation (by the action of reactive oxygen species) and endogenous antioxidants in cells and tissues. Reactive oxygen species are produced by some toxins, ultraviolet light, normal biochemical pathways and pathological events in cells (e.g., free radicals that escaped from the mitochondrial complex). Endogenous antioxidants include reduced glutathione and the enzymes superoxide dismutase, catalase, and glutathione peroxidase. Many plants contain antioxidants, as Echinacea, Ginseng, Ginkgo biloba, Garlic, St. John's wort, Peppermint, and others, including several typically used as food; some vitamins also have antioxidant activity [2]. Although there is little clinical evidence that supplementation with dietary antioxidants ameliorates or prevents any disease, there is a wealth of scientific evidence for the free radical scavenging ability of many plant-derived antioxidants thus, interest in this mechanism of action remains strong.

Immunomodulation

Some herbals are thought to act by modulation of immune function (Milk thistle, Dandelion, Echinacea, Licoricey, Cat's claw, and other). This modulation can be indirect, via antioxidant effects, or direct, via effects on immune cells. In general, herbal remedies are thought to enhance immune function by removing toxins from the body [3]. The herbal approach to immunomodulation is holistic and focuses on boosting liver function and cleansing the blood. In the herbal philosophy, detoxification by the liver has a crucial role in health and in regulating immune function. Again, there is a dearth of clinical evidence for the efficacy of any herbal medicine in altering the course of disease, but some evidence in animal models and cell cultures suggest possible effects on immune function.

Action on Neurotransmission

Many plants contain compounds that are used or abused for their psychoactive qualities, usually for sedative, stimulant, or analgesic purposes. These include coffee (caffeine), tobacco (nicotine), coca (cocaine), opium poppy (opiates), marijuana (cannabinoids), and peyote (mescaline). Ethnobotanical studies of shamanism in native populations have revealed many other hallucinogenic plants. A variety of herbal products are commonly used for sedative, stimulant, analgesic, and antiemetic effects [4].

Plants contain many compounds that may act on neurotransmitter receptors in the central and peripheral nervous systems. Plants also contain compounds that can: Interfere with the uptake of neurotransmitters, prolonging their action; stimulate or block neurotransmitter release; or alter the enzymatic degradation of neurotransmitters. Many of these compounds have been isolated and modified to produce drugs of common use today. The classic examples are the opiate narcotics found in the opium poppy. Compounds from the opium poppy have been modified chemically to yield products with increased specificity in terms of opioid receptor subtype and ability to activate or block these subtypes.

Hormonal Actions

Some herbs contain compounds that mimic or block the actions of hormones, notably estrogenic. Currently used products include highly concentrated extracts of phytochemicals synthetic derivatives, and even steroids like dehydroepiandrosterone and androstenedione, which are classified as dietary supplements because they are produced from plant precursor sterols. Phytoestrogens can be classified into three groups. Isoflavones are plant sterol molecules found in soy and other legumes. Lignin's are a constituent of the cell wall of plants and become bioavailable as a result of the effect of intestinal bacteria on grains. The highest amounts are found in the husk of seeds used to produce oils, especially flaxseed [5]. Coumestans are found high concentrations in red clover,

sunflower seeds, and bean sprouts. The plant lignin and isoflavonoid glycosides become hormone-like compounds exert measurable effects on circulating gonadotropins and sex steroids, suggesting they have biological activity. High isoflavone intake may depress luteinizing hormone levels and secondary depress estrogen production. Phytoestrogens can also act on intracellular enzymes, protein synthesis, growth factors, cellular proliferation, differentiation, and angiogenesis. Bean foods provide large amount of fibre, and fibre modifies the level of sex hormones by increasing gastrointestinal motility. Fibre also alters bile acid metabolism and partially interrupts the enterohepatic circulation, causing increased estrogen excretion by decreasing the rate of estrogen reuptake.

Other botanicals have been proposed to modify hormonal balance in men. Saw palmetto contains steroid-like compounds that may antagonize the actions of testosterone and its suggested for treatment of benign prostatic hyperplasia and prostate cancer. Tribulus and Tongkat Ali are thought to enhance testosterone production through stimulation of luteinizing hormone production. Yohimbe contains yohimbine, an antagonist at α 2-adrenergic receptors known to increase norepinephrine release by blocking inhibitory presynaptic auto receptors, thus enhancing sympathetic activity. Synthetic yohimbine is regulated as a drug and prescribed for erectile dysfunction, whereas yohimbe bark is sold as a dietary supplement. Pygeum may interfere with testosterone production by inhibition of 5- α -reductase and aromatase and is used for treating benign prostatic hyperplasia. DHEA is a naturally occurring adrenal hormone that is a precursor of estrogen and testosterone. Levels of DHEA decline with aging, so it is often used as a supplement to restore those levels toward more “youthful” values.

Anticancer Effects

Some herbal products have been suggested to prevent cancer by stimulating the immune system or by their antioxidant effects. Others are thought to act by direct toxic effects on neoplastic cells. Other postulated mechanisms include blockage of angiogenesis and reversal of multidrug resistance pumps, like properties of flavonoids. Herbs are also used to treat either the symptoms of cancer or the adverse effects of conventional chemotherapy, and radiation treatments. Several potent conventional cancer treatments are derived from plants and other natural products. These include taxol from Pacific yew and the vinca alkaloids from Madagascar periwinkle.

Many patients with cancer take large doses of vitamins and antioxidants with the belief that these compounds may boost immune function and prevent further neoplastic transformation. Patients believe that, at worst, these supplements can do no harm. However, current research indicates this may be incorrect. Because conventional cancer therapy frequently depends on oxidative mechanisms, it is possible that the use of antioxidants could interfere with this treatment. Also, recent evidence suggests that apoptosis of cancer cells is increased by reactive oxygen species, and antioxidants can slow or block this process. Patients undergoing either chemotherapy or radiation therapy should be advised not to exceed the upper limits for vitamin and mineral supplements and to avoid dietary supplements that contain high levels of antioxidants.

Ergogenics

Ergogenic are substances that increase energy production, use, or recovery. Many products claim to give athletes a competitive edge through an ergogenic effect. Surveys have shown that 75% of college athletes and 100% of body builders take supplements for this purpose. A handful of supplements on the market have been shown to be effective in high-quality clinical studies. Oral creatine supplementation can increase muscle phosphocreatine stores by 6% to 8%, leading to faster regeneration of adenosine triphosphate. Elevated levels of muscle creatine also buffer lactic acid produced during exercise, delaying muscle fatigue and soreness. Caffeine increases contractility of skeletal and cardiac muscle and stimulates fat metabolism, thereby sparing stimulant, which can aid in activities that require concentration. However, ergogenic doses of caffeine (250 to 500 mg) may cause restlessness, nervousness, insomnia, tremors, hyperesthesia, and diuresis.

Protein and amino acid supplements are used by some athletes to enhance muscle repair and growth. Athletes in training have increased protein needs, and inadequate protein intake causes a negative nitrogen balance, which slows muscle growth and causes fatigue. Carbohydrates, specially muscle glycogen, are the body’s main source of rapidly available energy. Loading, or increasing the carbohydrate content of the diet for several days before an athletic event, has been suggested to prolong exercise endurance. A meal before exercise will ensure that muscle and liver

glycogen stores are maximized. Studies investigating ingestion of food 2 to 4 hours before exercise have shown a positive effect, regardless of the “glycemic index” of the foods ingested. Replenishment with carbohydrate-containing fluids during an endurance event may also help delay fatigue. Eating a mixture of carbohydrates and protein within 2 hours after exercise has also been associated with benefits, including replenishment of depleted muscle and liver glycogen stores and decreased muscle catabolism.

CONCLUSION

Safety concerns about herbal medicines require well-designed toxicological and pharmacokinetic studies and may lead to more restrictive approval and marketing requirements and more stringent monitoring of several types of alternative medicine providers, including doctors of traditional Chinese medicine, naturopaths, homeopaths, and Ayurveda physicians. More research is needed to determine the advantages of these combined, integrated approaches, because this trend is been driven by patient demand as well as evidence for improvements in health care and outcomes.

ACKNOWLEDGMENTS

The author thanks to the Biosciences Department of UFRN to the help in execution of this work.

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