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Merrily A. Kuhn

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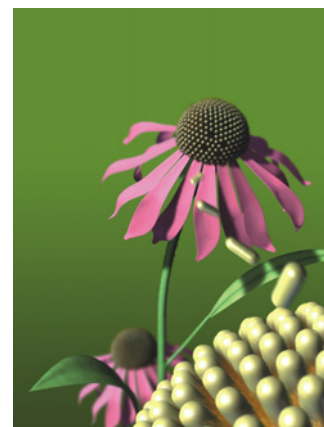
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Herbal Remedies: Drug-Herb Interactions

Merrily A. Kuhn, RN, PhD



This article has been designated for CE credit. A closed-book, multiple-choice examination follows this article, which tests your knowledge of the following objectives:

1. Identify issues related to standardization and quality control for herbal preparations
2. Describe the pharmacokinetic interactions of herbs on drugs
3. Discuss potential interactions of selected popular herbs and drug therapies

Herbs have been used for medicinal purposes since

the beginning of recorded time. Although most people in the United States believe that herbs are harmless plants, about one third of our drugs (including digitalis, morphine, atropine, and several chemotherapeutic agents) were developed from plants. So, indeed, herbs can be potent products. Herbs can affect body functions; therefore, when herbs are taken concurrently with drugs, interactions are possible.

Botanical medications have increased in popularity. In the United States, botanical products are now a \$1.5 billion per year industry. It is estimated that 60% to 70% of the American population is taking botanical products, but less than one third of these persons inform their medical practitioners of such use.¹

Today, our understanding of the interactions between drugs and herbs and between drugs and food is still in its infancy. Much

research is still required in herbal therapy to examine individual plant constituents and to determine how plants interact with drugs and food. Some researchers² suggest that drug-herb interactions occur less often than predicted. If an interaction between an herb and a drug does occur, conventional drugs are usually the culprits because they are more pharmacologically active.^{2,3} In this review article, I discuss several popular herbs and provide a comprehensive table that summarizes drug-herb interactions (see Table).

STANDARDIZATION AND QUALITY CONTROL

Because herbs are sold as food supplements, companies are not required to prove the efficacy of the herbs or determine the side effects or interactions of these products. Often, multiple ingredients are present in the same bottle, and products are sometimes mislabeled, misidentified, and adulterated. Currently, 30 herb companies have begun to share information on research, quality control, and processing; changes may therefore occur in the future. The potency of herbs can also

Merrily A. Kuhn is president of Educational Services in Hamburg, NY, and is an associate professor at Daemen College in Amherst, NY.

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Drug-herb interactions: "do not take together"

Herbal product	Drug, vitamin, or mineral product	Results/comments
Internal aloe vera, soaked flax seeds, fenugreek, sarsaparilla, slippery elm, plantain, psyllium seeds (Metamucil), marshmallow	All drugs	Binds with drugs; herbal product should be taken at least 2 hours before or 2 hours after any drugs ⁴
Flaxseed	Niacin	Increases flushing ⁵
Evening primrose oil	Phenothiazines	Increases likelihood of seizures ⁵
Bilberry fruit, bromelain, chamomile, chondroitin, cinchona bark, dan shen, dong quai, fenugreek, feverfew, garlic, ginger, ⁶ ginkgo, ⁷ ginseng (Asian, American), goldenseal, horse chestnut, huang qin, meadowsweet, methylsulfonylmethane, pau d'arco, papain, red clover, shiitake (water-soluble extracts), turmeric, vitamin E (> 2000 IU)	Warfarin, low-molecular-weight heparins, and maybe aspirin	Increase bleeding tendency, international standardized ratio may increase, alter bleeding times; patients should stop taking herbs at least 7 days before surgery ⁴
Bittermelon, burdock, chromium picolinate, fenugreek, garlic, ginseng (Asian, American), <i>Gymnema</i> , psyllium seeds	Antidiabetic drugs	May increase likelihood of hypoglycemia ⁸
Vitex (chasteberry)	Estrogen	Should not be used together ^{4,9}
Black cohosh	Estrogen	Probably safe ^{4,8,9}
Dong quai	Estrogen	Unknown effect: should not be used together ^{4,5,8,9}
Licorice	Estrogen	Safe together ^{5,9,10}
Flax, soy	Estrogen	Safe together ^{4,5,9}
Ginseng (Asian)	Coffee, tea, cola	Increases stimulation, tachycardia, hypertension ¹¹
	Antipsychotic agents, monoamine oxidase inhibitors (MAOIs)	May increase insomnia, headache, tremulousness ¹¹
	Corticosteroids	May potentiate medications or increase side effects ¹¹
Ginseng (Asian), guarana	Phenelzine sulfate (Nardil) and other MAOIs	Increase likelihood of headache, tremulousness, and manic episodes and blood pressure ^{11,12}
Hawthorn, ginseng, dan shen	Digoxin	Increase likelihood of toxic effects or may interfere with effectiveness of digitalis ^{4,13}
Licorice, uzara root, ginseng (Siberian), buckthorn (bark/berry)	Digoxin	May interfere with both monitoring and pharmacodynamic activity of digoxin ^{4,8}
Aloe (latex), buckthorn, cascara sagrada, castor bean, horsetail, licorice, rhubarb, senna	Cardiac glycosides, antidysrhythmics, diuretics, or laxatives	Increase potassium loss, may increase toxic effects of all listed drugs and lead to confusion, weakness, and dysrhythmia ^{4,8,11}
Licorice	Corticosteroids	Interferes with β -reductase, thus corticosteroid reduces elimination, increasing adverse and toxic effects ^{4,5,8}
Valerian	Sedatives	May intensify effects ^{10,12}
	Metronidazole (Flagyl), sleeping pills of any kind	Causes person to wake up hung over and groggy ⁸
Blue cohosh	Nitrates and calcium channel blockers	Theoretically, may antagonize the hypertensive effect; should be used cautiously together ⁹
Guggul as guggul lipid	β -Blockers, with calcium channel blockers	May diminish the effectiveness of drugs ^{4,8}
Hawthorn, guarana	β -Blockers	May potentiate ⁴
Plantain	Lithium, carbamazepine	May reduce absorption; should be ingested 2 hours before or 2 hours after drugs ^{4,8}

Continued

Drug-herb interactions: “do not take together” *Continued*

Herbal product	Drug, vitamin, or mineral product	Results/comments
Diuretic herbs, dandelion (often found in products to treat premenstrual syndrome, diet products)	Lithium Antihypertensives, diuretics	Sodium depletion may potentiate toxic effects of lithium ^{4,8,11,13} May potentiate effects (but not potassium loss because dandelion contains potassium); concurrent use should be avoided ^{4,8,11,13}
St John's wort, 5-hydroxytryptophan	Cough and cold products containing dextromethorphan; all selective serotonin reuptake inhibitors	Increases likelihood of serotonin syndrome ^{4,14}
Alfalfa, St John's wort, motherwort, parsley, celery St John's wort, saw palmetto	Chlorpromazine, tetracycline Iron	Increase photosensitivity ^{4,14} Tannic acids in both herbs may inhibit the absorption of iron; herbal product should be ingested at least 2 hours before or 2 hours after mineral ¹⁴
St John's wort, ashwagandha, kava kava, California poppy, gotu kola, hops, valerian, black cohosh, German chamomile, motherwort, passion flower, S-adenosylmethionine Schisandra, dan shen, ashwagandha	Alcohol, barbiturates, benzodiazepines Pentobarbital, barbital Caffeine, amphetamines	Have synergistic effect and increases sedative effect, may result in coma ^{4,15} Use cautiously together, may increase sedation ⁴ May antagonize central nervous system, stimulating effect ⁴
Green tea	Calcium	Decreases calcium absorption; tea should be ingested 2 hours before or after mineral ^{8,10,12}
Blue cohosh, lobelia	Nicotine patches	May increase side effects or potentiate patches; use together cautiously ⁹
Kava kava	All anti-Parkinson drugs	Increases tremor and may render medications less effective; should not be used together ^{4,8}
Vitamin C, kava kava, St John's wort	Tricyclic antidepressants	Decrease effectiveness, potentiate, increase adverse effects ^{8,9,11}
Hops, kava kava, passion flower	Hydroxyzine hydrochloride (Atarax), hydroxyzine pamoate (Vistaril), loratadine (Claritin)	May, in combination, have sedative action and exacerbate adverse effects of drowsiness and fatigue ^{4,8,11}
Turmeric, willow	Nonsteroidal anti-inflammatory drugs	May increase bleeding and increase gastrointestinal irritation ⁸
Selenium, vitamin C, fiber Ma huang (<i>Ephedra</i>)	Zinc Cardiac glycosides and anesthetics Quanethidine, stimulants, MAOIs, decongestants, guarana β-Blockers, theophylline, antidepressants, and all antihypertensive agents	Decrease zinc absorption ⁴ Increases likelihood of dysrhythmias ^{5,8,10} Enhances sympathetic activity; increases blood pressure ^{5,8,10} May cause hypertensive crisis, elevation of blood pressure, tachycardia, and increased anxiety ^{5,8,10}
Hawthorn Nightshade vegetables	Anesthetics Muscle relaxants	Theoretically, enhances hypotension ⁸ Enhance adverse effects; interfere with 2 enzymes that break down muscle relaxants and anesthetics ^{4,13}
Arnica, goldenseal, licorice, yohimbe, Asian ginseng Cat's claw, black cohosh, hawthorn	Antihypertensive agents Antihypertensive agents	Interfere with blood pressure control ^{4,8} May potentiate activity and increase risk of hypotension ^{8,9}
Arnica Most tinctures Flax seeds Cholestin	Antihypertensive agents Metronidazole (Flagyl) Laxatives	May reduce effectiveness of drugs ^{8,11} Antabuse (disulfiram) reaction ⁴ Potentiate laxative effect ⁴

Continued

Drug-herb interactions: "do not take together" *Continued*

Herbal product	Drug, vitamin, or mineral product	Results/comments
St John's wort	Cholesterol-lowering drugs	Potentiates adverse effects of drugs ⁸
	Cyclosporine (Sandimmune)	May decrease activity and increase risk of rejection; may increase activity of hepatic enzyme CYP3A4, thus lowering levels of drug ¹⁴⁻¹⁸
	Indinavir (Crixivan)	One study found reduced levels of drug, thereby increases drug resistance and treatment failure; more study is necessary ^{14,15,19}
	Digoxin	Decreases serum level of digoxin by as much as 25%; may reduce efficacy; should not be used concurrently ^{15,20}
	Theophylline	Worsens signs and symptoms of asthma; reduces serum level of theophylline
	Amitriptyline (Elavil)	Worsens depression; reduces serum level of amitriptyline
	Estrogen (birth control pill)	Breakthrough bleeding ¹⁵
Guarana ^{8,10-12}	Selective serotonin reuptake inhibitors	Increases occurrence of serotonin syndrome; lethargy, confusion, muscle stiffness ¹⁵
	Respiratory drugs	Increases likelihood of adverse effects because guarana contains theophylline; should not be used concurrently
	Caffeine products along with oral contraceptives, cimetidine, verapamil, and some quinolone antibiotics	Lowers caffeine clearance by 30% to 50%; should not be used concurrently
	Lithium	May inhibit clearance of lithium; should not be used concurrently
	Adenosine (Adenocard)	May lower response; should not be used concurrently
	Benzodiazepines	Drugs may be less effective; should not be used concurrently
	Antidysrhythmics	May interfere with drug activity ⁸
Devil's claw Lemon balm, bugleweed Nettles	Thyroid drugs	Interfere with thyroid hormone ⁸
	Diuretics, calcium carbonate and other antacids, chromium carbonate and other antacids	Reduce absorption ^{8,11}
	5-Hydroxytryptophan	
Melatonin ^{4,10,12}	All antidepressants, anti-Parkinson drugs, barbiturates, all tranquilizers, weight loss products, antihistamines, cold medications, alcohol, chemotherapeutic agents, antibiotics	May potentiate effects, particularly adverse effects; should not be used concurrently ⁴
	Calcium channel blockers	Enhances effects of light on retina; interferes with melatonin; should not be used concurrently
	Benzodiazepines	Enhances anxiolytic action; should not be used concurrently
Alfalfa, green tea ¹⁰⁻¹²	Methamphetamine	May exacerbate insomnia; should not be used concurrently
	Warfarin	Warfarin activity may be lowered because of high level of vitamin K in herb
Bromelain ^{4,10}	Antibiotics, anticancer drugs, (5-fluorouracil, vincristine)	Improves effectiveness and efficacy of drugs

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vary depending on the climate and soil conditions where they were grown. When a drug is prescribed, the dosage and quality of the product is more or less assured; such is not the case with herbs. Even with these drawbacks, herbs are an effective form of therapy.

DRUG INTERACTIONS

The first book on drug interactions was published in 1974. Since then, hundreds of texts have been compiled and written on this topic. A drug interaction is defined as any modification caused by another exogenous chemical (drug, herb, or food) in the diagnostic, therapeutic, or other action of a drug in or on the body. The possibilities of drug interaction are endless, because more than 30 000 over-the-counter products; more than 1000 unique chemical substances from which prescription drugs are produced; and hundreds of herbs, vitamins, and minerals are available. The risk for drug interactions increases with the number of products consumed: for 2 products, the risk is 6%; for 5 products, 50%; and for 8 or more products, 100%.²² The mechanisms for drug interaction can be divided into several general categories: pharmacokinetics (absorption, distribution, metabolism, and excretion of a drug) and pharmacodynamic interactions (the combined pharmacological effects of a drug).

DRUG-HERB INTERACTIONS

The mechanism of action of many herbs has not been determined. Therefore, the exact mechanisms of drug-herb interaction are also unknown. To date, several

pharmacokinetic drug-herb interactions (absorption, distribution, metabolism), and several additive pharmacodynamic interactions have been identified.

Pharmacokinetic Interactions

Absorption. Herbs that have hydrocolloidal carbohydrate components such as gums and mucilage are soluble in water but poorly absorbable; examples include psyllium, rhubarb, flaxseed, marshmallow, and aloe. These compounds are apt to bind to other drugs, particularly when consumed in their whole or powdered forms. For example, psyllium (an herb high in mucilage) inhibits the absorption of lithium. Rhubarb and aloe can cause diarrhea, which reduces the action of drugs that have a narrow therapeutic index (eg, digoxin, warfarin).³ In order to prevent an herb from binding with drugs, the drug should be taken 1 hour before or 2 hours after these herbal products.²³

Distribution. Herbs such as meadowsweet and black willow, which contain pain-reducing salicylates, may displace highly protein-bound drugs such as warfarin and carbamazepine (Tegretol),^{2,3} thus increasing the adverse effects of the drugs. These products should not be taken concurrently.

Metabolism. Licorice (as an herb, not a sweetener) decreases the metabolism of corticosteroids, leading to adverse and toxic effects from the buildup of corticosteroids. Recently, researchers^{2,3} discovered that St John's wort can induce hepatic microsomal enzymes in the cytochrome P-450 system; thus, it increases the metabolism of drugs metabolized in this system, such as digoxin and

theophylline, protease inhibitors, and cyclosporine. The drugs are thus rendered less effective, so concurrent use of licorice with these drugs is not recommended.

Pharmacodynamic Interactions

An example of a pharmacodynamic interaction is additive activity. For example, the hypnotic activity of benzodiazepines is increased by valerian, and the anticoagulant action of warfarin is enhanced by ginkgo and possibly by many other herbs (see Table).³ It is best not to take these products concurrently.

SELECTED POPULAR HERBS

Ginkgo (*Ginkgo biloba*)

Ginkgo is often used by elderly persons because of its ability to improve cognitive function in persons with Alzheimer's disease and dementia^{24,25} and to improve blood flow in persons with peripheral vascular disease, tinnitus, or memory impairment.²⁶ To date, several reports of bleeding associated with use of ginkgo have been published.^{7,27-31} Patients who experienced bleeding were from 33 to 78 years old; one person was taking no other drugs concurrently, whereas several other patients were taking aspirin, warfarin, acetaminophen, or an ergotamine-caffeine preparation concurrently. Patients had both minor and major episodes of bleeding, and one person died of a massive cerebral hemorrhage.²⁸

Patients taking other products known to affect platelet activity, such as vitamin E (>1200 IU), excessive garlic (the equivalent of 15 to 20 cloves/day), warfarin, aspirin, and low molecular weight heparins, should be cautioned

about the potential interaction of those products with ginkgo. Patients taking ginkgo should be counseled to inform their health-care providers of unusual bleeding and bruising or a new onset of dizziness, headache, or blurred vision.

Flaxseed (*Linum usitatissimum*)

Flax is one of the oldest cultivated plants in the world. Flax is grown for its fiber (linen), seed oil (linseed oil), and seeds (flaxseed). Flax is a bulk-producing, stool-softening agent that lowers levels of cholesterol (9%), triglycerides, and low-density lipoproteins (18%).³² By binding to bile acids in the intestinal tract, flax interferes with the reabsorption of fats.³³⁻³⁶ When soaked, flaxseeds have mucilaginous properties and can bind with drugs, especially cardiac glycosides, rendering them unabsorbable. Therefore, flaxseed should be taken either 2 hours after or 2 hours before the consumption of other products (drugs, vitamins, and minerals). In addition, concurrent use of flaxseed with laxatives and stool softeners should be avoided because of the possible potentiation of the laxative effect.³⁷

Feverfew (*Tanacetum parthenium*)

Feverfew is most commonly used to reduce the number and the severity of migraine headaches^{2,38} and has anti-inflammatory activity. Feverfew suppresses prostaglandin production but does not inhibit cyclooxygenase.³⁹ Feverfew inhibits platelet activity, so it should not be taken concurrently with warfarin or other drugs that affect clotting.⁴⁰ Feverfew is also a member of the daisy family, and

is therefore contraindicated in persons with allergy to ragweed.⁴

Ginger (*Zingiber officinale*)

Ginger has been used and tested as an anti-nauseant and antispasmodic agent with very good results.⁴¹⁻⁴³ Ginger is a potent inhibitor of thromboxane synthetase and thus prolongs bleeding time.⁴⁴ Therefore, persons taking warfarin or other drugs that affect platelet activity should refrain from taking ginger in tablet form.^{2,4,44} Using ginger as a spice is not a problem.

Kava Kava (*Piper methysticum*)

Kava kava is cultivated throughout the South Pacific and has been used for hundreds of years as a ceremonial drink. Kava kava relieves anxiety, nervousness, and tension without affecting alertness.^{2,33} Kava acts as a dopamine antagonist and therefore may increase tremor and make medications less effective in persons with Parkinson disease.^{2,45} Kava also potentiates alcohol, tranquilizers, and antidepressants, which should therefore not be taken concurrently with kava.^{2,45,46}

St John's Wort (*Hypericum perforatum*)

St John's wort is one of the most popular herbs in the United States for the management of depression.^{2,4} For many years, St John's wort was thought to act as a monoamine oxidase inhibitor, but this hypothesis has never been confirmed. Current research suggests that St John's wort acts as a selective serotonin reuptake inhibitor (SSRI).^{47,48} Therefore, concurrent use of SSRIs with St John's wort is contraindicated.^{15,49} Patients should wait at least

2 weeks after taking an SSRI before starting to take St John's wort, or between stopping taking St John's wort and starting to take an SSRI.³³ The newest research suggests that St John's wort may act in the cytochrome P-450 system of the liver. Concentrations of indinavir, a protease inhibitor used to treat infection with human immunodeficiency virus, were reduced, possibly leading to drug resistance and treatment failure.^{15,19,47} Markowitz et al¹⁴ studied the action of St John's wort on the cytochrome P-450 system in the liver, and their results indicated that St John's wort was unlikely to inhibit the CYP2D or CYP3A4 liver enzyme systems. More research is needed.

Other researchers^{15,20} today are suggesting that St John's wort may have an effect like that of grapefruit juice on the metabolism of many drugs. In another study,¹⁶ 2 transplant recipients who were taking cyclosporine (definitely metabolized in the liver) experienced transplant rejection.^{18,47} Much more research is needed to determine the effect of St John's wort on the metabolism of other drugs.

St John's wort also is associated with photosensitivity, so other photosensitizing herbs (eg, dong quai) or photosensitizing drugs (eg, tetracyclines and chemotherapeutic drugs) should not be taken concurrently.^{2,4} Persons taking St John's wort should be careful about their exposure to sun.

REPORTING INTERACTIONS

In May 1998, the Food and Drug Administration (FDA) announced the development of a searchable database containing reports of adverse events associated

with the use of special nutritional products (eg, dietary supplements, infant formulas, and medical foods). Reports are received from health professionals or patients and consumers via the FDA's Med Watch program,⁵⁰ FDA field offices, and other federal and local public health agencies or via correspondence received by the FDA. This system allows both reporting of adverse events and searching of events currently in the database. Access may be obtained via the Internet at <http://vm.cfsan.fda.gov/~dms/aems.html> or by telephoning (800) FDA-1088.

IMPLICATIONS FOR NURSING

Nurses should become educated about the herbal products that patients are consuming. Objective information about herbal products can be obtained in publications such as *Alternative Medicine Alert* [(800) 688-2421], *Review of Natural Products* [(314) 216-2100], *Herbal Therapy and Supplements, A Scientific and Traditional Approach* [(800) 724-9866], and *Complementary Therapies for Health Care Providers* [(800) 724-9866].

A comprehensive assessment requires the nurse to identify prescribed medications, over-the-counter medications, dietary supplements, and complementary therapies used by patients.⁴ Often, patients neglect to report use of herbal substances because they underestimate the significance of these substances in relation to the whole clinical picture. Some patients may be reluctant to divulge information about use of "unorthodox" therapies to persons seen as "conventional" healthcare providers.

Preoperative assessment of use of herbal products is important. Use of all herbal products should be discontinued 5 to 7 days before surgery. Because pharmacokinetic information on most herbs is not available, how long it takes for most herbal products to be cleared from the body is not known. If a patient is having an emergency procedure, nurses should specifically ask about herbs that affect clotting, including bromelain, cayenne pepper, chamomile, cinchona bark, dong quai, fenugreek, feverfew, garlic, ginger, ginkgo, ginseng, guggul, horse chestnut, vitamin E (>1200 IU), and willow bark (see Table). This information should be discussed with the medical staff.

Determining the use of herbal substances is an important aspect of patients' assessment and may influence nursing interventions. Patients may also seek advice from nurses about the use of herbal substances and about the efficacy and safety of those herbal products.

SUMMARY

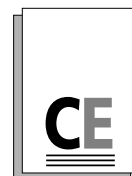
Controlled clinical studies are needed to clarify and determine the clinical importance of drug-herb interactions. However, it is unlikely that this information will be forthcoming except as anecdotal reports. Patients taking drugs with a narrow therapeutic index (cyclosporine, digoxin, hypoglycemic agents, lithium, phenytoin, procainamide, theophylline, tricyclic antidepressants, and warfarin) should be discouraged from using herbal products.^{2,51} All drugs with a narrow therapeutic index may either have increased adverse effects or be less effective when used in conjunction with herbal products. More research is

required to define the interactions. When adverse reactions are experienced with drug therapy, patients must always be queried as to their intake of herbal products: what they are taking in pills and tincture form, what they are drinking as teas, and what they are eating from their garden.^{3,51} ❧

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CE Test Instructions

To receive CE credit for this test (ID C022), mark your answers on the form below, complete the enrollment information, and submit it with the \$12 processing fee (payable in US funds) to the American Association of Critical-Care Nurses (AACN). Answer forms must be postmarked by April 1, 2004. Within 3 to 4 weeks of AACN receiving your test form, you will receive an AACN CE certificate.

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AMERICAN
ASSOCIATION
of CRITICAL-CARE
NURSES

Test ID: C022

Test writer: Ruth Kleinpell-Nowell, RN, PhD, CS, CCNS

Form expires: April 1, 2004

Contact hours: 2.0

Passing score: 9 correct (75%)

Category: A

Test fee: \$12

CE Test Form

Herbal Remedies: Drug-Herb Interactions

Objectives:

1. Identify issues related to standardization and quality control for herbal preparations
2. Describe the pharmacokinetic interactions of herbs on drugs
3. Discuss potential interactions of selected popular herbs and drug therapies

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Program evaluation

	Agree	Neutral	Disagree
Objective 1 was met	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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Objective 3 was met	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The content was appropriate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My expectations were met	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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The level of difficulty of this test was:

☐ easy ☐ medium ☐ difficult

To complete this program, it took me _____ hours / minutes.

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Mark your answers clearly in the appropriate box. There is only 1 correct answer. You may photocopy this form.

Mail this entire page to AACN, 101 Columbia, Aliso Viejo, CA 92656, (800) 899-2226

CE Test Questions

Herbal Remedies: Drug-Herb Interactions

1. What estimated percentage of the American population is taking botanical products?
 - a. 10% to 20%
 - b. 30% to 40%
 - c. 50%
 - d. 60% to 70%
2. Herbs are sold under which one of the following categories?
 - a. Vitamins
 - b. Food supplements
 - c. Organic products
 - d. Botanical products
3. Which one of the following is not considered a standardization and quality control issue for herbs?
 - a. Potency
 - b. Mechanism of action
 - c. Efficacy
 - d. Effectiveness
4. What is the risk of a drug interaction with the consumption of 5 products?
 - a. 10%
 - b. 20%
 - c. 35%
 - d. 50%
5. To prevent an herb from binding with drugs, when is it best to take the drug in relation to the herbal product?
 - a. Take the drug and herbal product together.
 - b. Take the drug 1 hour before or 2 hours after the herbal product.
 - c. Take the herbal product 1 to 2 hours before the drug.
 - d. Take the herbal product 1 to 2 hours after the drug.
6. Which one of the following drugs may have an interaction with *Ginkgo biloba*?
 - a. Lithium
 - b. Warfarin
 - c. Cylcosporine
 - d. Digoxin
7. An additive activity interaction can occur with which one of the following drug and herb combinations?
 - a. Flax and stool softeners
 - b. Licorice and aspirin
 - c. Valerian and benzodiazepines
 - d. Aloe and warfarin
8. Which one of the following herbs is used as an antinauseant and antispasmodic agent?
 - a. Feverfew
 - b. Ginger
 - c. Kava kava
 - d. Rhubarb
9. Which one of the following is one of the most popular herbs in the United States for the management of depression?
 - a. Kava kava
 - b. *Ginkgo biloba*
 - c. St John's wort
 - d. Black willow
10. Use of herbal products should be discontinued how many days before surgery?
 - a. 1 to 2 days
 - b. 2 to 3 days
 - c. 4 to 5 days
 - d. 5 to 7 days
11. Drugs with a narrow therapeutic index may have what type of effect when used in conjunction with herbal products?
 - a. Increased
 - b. Unknown
 - c. Opposite
 - d. No effect
12. All of the following drugs have a narrow therapeutic index that may be affected by herbal product use, except which one?
 - a. Digoxin
 - b. Lithium
 - c. Warfarin
 - d. Lasix

