Ginsenoside variability in American ginseng samples

Dear Sir:

Ginseng root has been used for >2000 y in the belief that it is a panacea and promotes longevity. Originally labeled as an adaptogen, ginseng helps to increase resistance to stress and restore homeostasis (1). The major active components of ginseng are ginsenosides, a diverse group of steroidal saponins that target a myriad of tissues, producing an array of pharmacologic responses (2). Recently, Harkey et al (3) performed a comprehensive study in which they analyzed the variability in commercial ginseng preparations. Consistent with previous reports (4), they found significant variability between the measured concentrations of ginsenosides in product samples and the amount labeled on the products.

The potency of herbal products can vary from manufacturer to manufacturer and from lot to lot (5), partly because of nonstandard processing and manufacturing methods. In addition, the variability of cultivation conditions (eg, soil, temperature, moisture, length of cultivation, and harvest season) affects the total ginsenoside concentration and the percentages of individual ginsenosides in the plants. Therefore, the degree of effects from a single ginseng species cultivated in 2 different countries can vary widely. Our previous pharmacologic study showed that the inhibitory activity of extracts of Panax quinquefolius (American ginseng) cultivated in the United States was significantly stronger than that of American ginseng cultivated in China (6).

We measured ginseng’s ability to modulate neuronal activity in the brainstem when the extracts were applied to the gastric compartment of an in vitro animal preparation. In the 28 neurons tested, American-cultivated American ginseng extract (30 mg/L) inhibited the neuronal activity of the brainstem by 37 ± 8.3% (P < 0.01) (6). Whereas Chinese-cultivated American ginseng with a higher concentration of extract (100 mg/L) inhibited the neuronal activity of the brainstem by only 18 ± 8.3% (P < 0.01) (6).

We recently used HPLC to evaluate the effects of different American ginseng samples on brainstem activity (7). Wisconsin-cultivated American ginseng was obtained from the Roland Ginseng LLC in Marathon; the roots were 4 y old and had been grown in a field partially shielded by a man-made shelter. Illinois-cultivated American ginseng was obtained from a private farm near Champaign; the roots were 5 y old and had been grown in a forest. The same extraction method was used for both samples (6). The high-pressure gradient HPLC instrument used was manufactured by Shimadzu Corporation (Kyoto, Japan). The chromatographic procedure was performed on a Prodigy C18 5-μm analytic column (150 × 3.2 mm; Phenomenex, Torrance, CA) protected by a C8 guard column (30 × 3.2 mm; Phenomenex). The ginsenosides were separated by gradient elution with eluents A (water) and B (acetonitrile) according to the following profile: 10–40% B over 60 min (curve 1) and then 40% B up to 70 min at a flow rate of 0.6 mL/min and 22°C. The ultraviolet detector range was 0.01 absorbance unit full scale, and the wavelength was 202 nm. Dried powder from the Wisconsin-cultivated (20.5 mg) and Illinois-cultivated (20.4 mg) extracts were each dissolved in 1000 μL 90% MeOH; 20 μL of each solution was injected into the system. In a comparison of 6 ginsenosides from these 2 specimens, our data showed remarkable variability in the total concentration and in the percentages of individual ginsenosides. For example, of the 2 major ginsenosides, the Illinois-cultivated American ginseng had ≈30% less ginsenoside Rb1 and 25% more ginsenoside Re than did the Wisconsin-cultivated American ginseng (7).

There is enormous public enthusiasm for the use of herbal medications. Ginseng, one of the best-selling herbs in the United States, is reported to have beneficial effects (2). However, because most previous animal studies and clinical trials of ginseng pharmacology used preparations with variable phytochemical contents, the results of these studies cannot be compared to determine the effectiveness of ginseng. Furthermore, the safety of herbal preparations is of primary importance to physicians (8, 9). Potential adverse effects of ginseng include hypoglycemia, an increased risk of bleeding, and a decreased anticoagulant effect of warfarin (9). The variability in the effectiveness of ginsenosides observed in our study (7) complicates our prediction of clinical outcome. Some herbal manufacturers have tried to standardize products to fixed concentrations of selected chemical constituents (10); however, the benefit of this effort is uncertain because herbs may achieve their effectiveness through the combined or synergistic actions of different compounds. Therefore, future investigations of the effectiveness of ginseng must focus on the use of standard methods and preparations.

Chun-Su Yuan
Ji An Wu
Joachim Osinski

Tang Center for Herbal Medicine Research
Department of Anesthesia and Critical Care
University of Chicago
Chicago, IL 60637
E-mail: cyuan@midway.uchicago.edu

REFERENCES

Erratum


On page 1060, column 2, paragraph 3, the iron content of the control diet is incorrectly stated as 100 μg. The sentence should read as follows: The control diet contained 30 μg Zn/g diet as zinc carbonate and 20 μg Fe/g diet as iron sulfate.