

## **Estrogen and progestin bioactivity of foods, herbs, and spices.**

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In this study we report on the content and bioactivity of plant (phyto) estrogens and progestins in various foods, herbs, and spices, before and after human consumption. Over 150 herbs traditionally used by herbalists for treating a variety of health problems were extracted and tested for their relative capacity to compete with estradiol and progesterone binding to intracellular receptors for progesterone (PR) and estradiol (ER) in intact human breast cancer cells. The six highest ER-binding herbs that are commonly consumed were soy, licorice, red clover, thyme, tumeric, hops, and verbena. The six highest PR-binding herbs and spices commonly consumed were oregano, verbena, tumeric, thyme, red clover and damiana. Some of the herbs and spices found to contain high phytoestrogens and phytoprogestins were further tested for bioactivity based on their ability to regulate cell growth rate in ER (+) and ER (-) breast cancer cell lines and to induce or inhibit the synthesis of alkaline phosphatase, an end product of progesterone action, in PR (+) cells. In general, we found that ER-binding herbal extracts were agonists, much like estradiol, whereas PR-binding extracts, were neutral or antagonists. The bioavailability of phytoestrogens and phytoprogestins in vivo were studied by quantitating the ER-binding and PR-binding capacity of saliva following consumption of soy milk, exogenous progesterone, medroxyprogesterone acetate, or wild mexican yam products containing diosgenin. Soy milk caused a dramatic increase in saliva ER-binding components without a concomitant rise in estradiol. Consumption of PR-binding herbs increased the progestin activity of saliva, but there were marked differences in bioactivity. In summary, we have demonstrated that many of the commonly consumed foods, herbs, and spices contain phytoestrogens and phytoprogestins that act as agonists and antagonists in vivo.

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