Phytoestrogens

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Estrogens are a group of steroid hormones that function as the primary female reproductive messengers. Estrogen has its etymological roots in the Anglo-Saxon goddess of fertility Oestre, and can be broken down as follows: from *estrus* (period of fertility for female mammals) + *gen* (to generate).

There are three types of estrogens known:

- **Estradiol**- the most potent and abundant estrogen, produced primarily from the follicles and corpus luteum in the ovaries; primary hormone involved in the development of secondary sex characteristics and the menstrual cycle
- **Estrone** – least abundant estrogen; levels higher during menopause (think crone)
- **Estriol** – primarily produced in pregnancy by the placenta

Estrogens are primarily produced in the ovaries but some of the body's supply comes from the conversion of androgens (male reproductive hormones) by the aromatase enzyme. This conversion (aromatisation) takes place primarily in adipose tissue (fat), but also occurs in the brain, skin, muscle, and bones. This secondary source of estrogen is particularly important after menopause as it supplies most of the body's estrogen. During the reproductive years this process can account for a significant gain in circulating estrogen levels as evidenced by the experience of some women who have undergone surgical removal of their ovaries without menopausal symptoms. Excess aromatisation has been linked to breast, adrenal, and prostate cancers.

Estrogen is responsible for the development of secondary sex characteristics during puberty and the growth of the endometrial lining during the menstrual cycle. Other effects seen in the presence of estrogen are strengthening bones, maintaining skin and blood vessel elasticity, increasing vaginal lubrication, increasing platelet adhesiveness (clotting), and increasing HDL cholesterol while lowering LDL cholesterol.
In addition, estrogens can elicit cell proliferation in estrogen-dependent tissue,
such as the breasts and endometrium.

Endogenous estrogens are produced within the human body, as opposed to the externally generated phytoestrogens and xenoestrogens (endo= within; gen=generated).

Endocrine disruptors, or hormone disruptors, are human-made chemicals in the environment that interfere with the development and function of body systems in animals, including humans. The endocrine system is the body's messenger service, integrating all other systems through hormones, which deliver the actual messages. Hormones regulate metabolism, sexual development and reproduction, mental processes, growth, and prenatal development.

Xenoestrogens are a subclass of endocrine disruptors that are able to bind to estrogen receptor sites and elicit an estrogenic affect. Hormone disruptors interfere with the healthy functioning of the endocrine system by binding to hormone receptor sites, thus producing a number of unnatural responses. They can mimic the natural hormones in our bodies, such as estrogens. They may also block our natural hormones, such as androgens (male hormones), thyroid hormones, and progesterone. Finally, they can alter the way in which natural hormones are produced, eliminated, or metabolized.

Since the 1940s, approximately 87,000 synthetic new chemicals have been produced in the United States alone (1). Only between 1.5 and 3 percent of synthetic chemicals have been tested for their cancer-causing properties, and even fewer have been tested for hormone-disrupting properties.

These human-made chemicals are the building blocks or byproducts of pesticides, fuels, detergents, plastics, and many everyday household objects. They can be found anywhere from cheese and the plastic wrap in which it is sold, to children's toys and teething rings. Some common examples are dioxins (created when plastic is manufactured and burned), PCBs (previously used as electrical insulator, adhesive, and lubricant), and DDT (banned from use in this country but still manufactured domestically and sold abroad). These chemicals do not observe political boundaries; they travel freely through air and water currents. For example, DDT sprayed in Peru to control mosquito populations can appear in the breast milk of an Aleutian mother in Alaska five years later.

For more information on endocrine disruptors, please see the resources at the end of this paper and my article on the subject.

Phytoestrogens are a diverse group of compounds, found in plants, which have the ability to bind to estrogen receptor sites and elicit an estrogenic effect (*phyto* = plant,*estrogen* = estrus [period of fertility for female mammals] + *gen* = to generate). They are found in many commonly eaten seeds, grains, and beans and are present in numerous medicinal herbs used to treat female reproductive disorders. Their effects are the subject of thousands of studies; it can be quite challenging to unravel the seemingly contradictory findings. It appears that phytoestrogens exert a weaker estrogenic effect on cells than endogenous estrogens or xenoestrogens. Varying substances can bind to the same receptor site and elicit differing effects, depending on the exact molecular fit. **Phytoestrogens exert an anti-estrogenic effect premenopausally** by competitive inhibition of hormone receptor sites. If the receptor sites are occupied with the less estrogenic phytoestrogens, than there are less sites available for the more potent endogenous estrogens or xenoestrogens. **Thus eating a whole foods diet rich in naturally occurring phytoestrogens is one of the ways we can protect ourselves from the harmful effects of environmental xenoestrogens.**

In **menopausal** and post-menopausal women a net reduction in estrogen occurs as the ovaries begin to rest. In this case the phytoestrogens can increase the positive effects of estrogen by increasing the estrogenic effect on the body. Although the phytoestrogens are less estrogenic than endogenous estrogens, they still increase the net estrogenic effect. This is evidenced by epidemiological studies demonstrating fewer menopausal symptoms, greater bone density, and lower breast cancer in populations of women who regularly consume phytoestrogens as part of their diet.

Our **pre-agricultural predecessors** evolved with a diet consisting of abundant seeds, nuts, fruits, and wild greens and roots, all of which contain ample phytoestrogens. I would venture that our reproductive systems, including our hormones and the endocrine glands that regulate our hormonal balance, evolved with these complex dietary inputs. Without these foods in our diet, we are introducing a **new twist to our hormonal systems**, and the consequence, I believe, is an increase in reproductive disorders. Most modern peoples in wealthy industrialized nations have a diet sorely lacking in whole foods phytoestrogens coupled with a hearty exposure to endocrine disruptors. It is my belief that these two factors play a large role in the increasing rates of reproductive cancers, endometriosis, uterine fibroids, ovarian cysts, infertility, and benign prostatic hypertrophy.

Types of Phytoestrogens:

Isoflavones (genistein, daidzein, formononetin, and biochanin A) are produced primarily in the bean or legume family (Fabaceae) and are some of the most potent and studied phytoestrogens. Isoflavones are anti-oxidant compounds that have demonstrated activity against breast and prostate cancer.
Soybeans (*Glycine max, Fabaceae*) appear to be some of the best dietary sources of isoflavones (2).

Soy foods, listed in order of isoflavone content, include miso, tempeh, soymilk, tofu, and edamame.Note: Most studies show that soy possesses significantly higher levels of isoflavones as compared to other beans, but James Duke's research has produced very different results (3). Whether this is due to variation in methodology or research funding, I am not sure. Personally, I would love to see this research replicated by unbiased sources (not to imply that the USDA would ever be influenced by the humble and meek soy lobby).

Soy is one of the most controversial foods today, vilified as either a harmful substance or praised for its nutritional superiority. There are some obvious negative aspects to soy: it is a common allergen, difficult for many to digest, and typically grown as a genetically modified monoculture. Another issue with soy is recognizing the difference between its traditional whole foods forms (tempeh, miso, tamari, edamame, and tofu) and the industrially produced fractionated form of soy protein isolate. Much of American soy consumption is from the latter form as processed meats from fast foods.
Traditional Asian cultures ingest about one ounce of soy daily on average, often in fermented forms such as tempeh, miso, and tamari. Many people who find that soy is harder to digest than other beans have an easier time digesting its fermented versions. I believe that soy, when eaten in its fermented form, in moderation, is beneficial as a high protein phytoestrogen, with all of the inherent benefits, including increased bone density; fewer menopausal symptoms; and lowered incidence of breast, uterine, and prostate cancers. Soy, in my opinion, is a medicinal bean, rather than an ideal staple source of protein.

Isoflavone absorption is greatly enhanced by healthy populations of intestinal flora. Multiple studies have been conducted utilizing isolated isoflavones in isolated cell lines *in vitro,* many of which have fueled the soy debate. Some *in vitro* studies examining genistein as an isolate have demonstrated promotion of breast cancer cell lines, but the majority of population studies have demonstrated positive health effects, such as increased bone density and lower LDL cholesterol levels. It appears that soy consumption via breastfeeding (with mothers who consume soy foods) and in youth reduces breast and prostate cancer later in life (4). Population studies show that early consumption of soy is also linked to a reduced amount of menopausal symptoms.
Herbal sources of isoflavones include red clover (*Trifolium pratense*, *Fabaceae*) and alfalfa (*Medicago sativa, Fabaceae*)

Lignans are the most widely consumed phytoestrogen precursors found in the western diet and are found in high concentrations in **flax** and **sesame** seeds and to a lesser extent in other seeds, whole grains, fruits, vegetables, and beans (5). Flax has about ten times the lignan levels as sesame. Intestinal flora act upon the lignans to convert them to their active forms: enterodiol and enterolactone (5). Enterolactone has been shown to inhibit the proliferation of prostate cancer *in vitro.* These phytoestrogens metabolites generally have a weaker estrogenic effect compared to the isoflavones. Note the importance of intestinal flora health in phytoestrogen metabolism. The repeated use of antibiotics and subsequent damage to intestinal bacteria has been linked to an increased risk of breast cancer, perhaps in part due to the lowered production of active phytoestrogen metabolites.

Lignans are not present in the oil portion of the seed, so sesame and flax oil are not good sources, unless the lignans are added back to the oil after it has been pressed. In my experience, high-lignan flax oil rapidly turns into oil suspended over a gooey, messy, insoluble mass, which is not entirely appetizing or even accessible. Both flax and sesame seeds, in their whole form, have a nasty habit of passing through the gastro-intestinal system unscathed and undigested. I recommend grinding them fresh and adding them to food after the food has been cooked. **Grind flax** with a hand grinder, coffee grinder, or blender and store it refrigerated for a week. Add it to oatmeal, or other breakfast gruels, salad, stir-fries, and baked goods. As for sesame, I like to toast the seeds in a dry cast iron skillet and then grind the seeds after they have cooled, with a little salt or seaweed. This traditional Japanese condiment is called **gomasio**; try it sprinkled on salads, soup, and stir-fries. **Tahini**, which is made from ground sesame seeds, is another viable source of lignans.

Flavanoids are well known for their potent anti-oxidant and anti-inflammatory effect. Most flavanoids also demonstrate a weak phytoestrogenic affect. Most yellow, red, purple, and black fruits contain are rich in flavanoids.

Coumestrol is a phytoestrogen found in high concentrations in sprouted soy and red clover and to a lesser extent in non-sprouted beans and peas.

Phytoestrogen or Endocrine regulator?

Many herbs traditionally used to balance hormones and treat reproductive disorders are not phytoestrogens, but instead affect the hypothalamic-pituitary-gonad interplay. In other words, the active compounds in these herbs do not bind to estrogen receptors sites per se, but instead balance hormone levels by affecting the hormonal regulators themselves. Wild Yam (*Dioscorea spp., Dioscoreaceae*), Chaste tree (*Vitex agnus-castus, Lamiaceae*), and Sarsparilla (*Smilax spp., Smilacaceae*) fall into this category. Many traditional reproductive herbs used to treat conditions such as infertility, painful menstruation, and heavy bleeding are both phytoestrogens and hormonal regulators.
Here is a partial list of herbs that have demonstrated phytoestrogenic activity:

Fenugreek (*Trigonella foenum-graecum, Fabaceae*), licorice (*Glycyrrhiza glabra and uralensis, Fabaceae*), ginseng (*Panax quinquefolius and P. ginseng, Araliaceae*), hops (*Humulus lupulus, Cannabaceae*) shatavari (*Asparagus racemosus, Asparagaceae*), red clover (*Trifolium pratense, Fabaceae*) and alfalfa (*Medicago sativa, Fabaceae*). Note that each of these herbs differs energetically with its unique personality, and thus should be paired with the individual's constitution and symptoms.
In **conclusion,** a varied whole foods diet rich in the above plant-derived compounds, provides ample phytoestrogens. Eating fresh, seasonal, and local whole plant foods is all our early ancestors have ever done. It seems reductionistic to focus on "power" phytoestrogens, a strategy so common in our culture, which believes more is always better. But considering the widespread exposure of novel environmental compounds and their high potential to wreak hormonal havoc, it is my opinion that it is prudent to focus our diets around the more potent phytoestrogens.

Sources

1. Pew Environmental Health Commission – Healthy from the Start Companion Report

2. USDA Database for the Isoflavone Content of Selected Foods. Prepared by Seema Bhagwat, David B. Haytowitz and Joanne M. Holden. Nutrient Data Laboratory Beltsville Human Nutrition Research Center Agricultural Research Service U.S. Department of Agriculture http://www.ars.usda.gov/SP2UserFiles/Place/12354500/Data/isoflav/Isoflav_R2.pdf

3. http://www.planetherbs.com/specific-herbs/is-soy-richer-in-isoflavones.html

4. Gene Expression and Reproductive Health. Jillian Stansbury, ND. Medicines from the Earth. Offical Proceedings. June 4-7, 2010. P138-142.

5. Linus Pauling Institute – Oregon State Universityhttp://lpi.oregonstate.edu/infocenter/phytochemicals/lignans/ – sources

Resources/bibliography

Women, Hormones and the Menstrual Cycle – Ruth Trickey
In depth coverage of the disease process, and dietary, lifestyle and herbal remedies for most of the female reproductive disorders encountered. Advanced and somewhat technical – geared towards health practitioners.

Botanical Medicine for Women's Health. Aviva Romm

Hormone Deception. D. Lindsey Berkson.

Our Stolen Future: Are we Threatening our Fertility, Intelligence and Survival? A Scientific Detective Story.
Theo Colborn, Dianne Dumankoski and John Peterson Myers.

Herbal Constituents: Foundations of Phytochemistry. Lisa Ganora

Having Faith: An Ecologist's Journey to Motherhood. Sandra SteingraberHormonal Enzyme Systems and Botanical Agents. Jillian Stansbury, ND. P134-137. Medicines from the Earth. Offical Proceedings. June 4-7, 2010.

Websites describing endocrine disruptors:

http://www.niehs.nih.gov/health/topics/agents/endocrine/

http://extoxnet.orst.edu/faqs/pesticide/endocrine.htm

http://www.nrdc.org/health/effects/qendoc.asp