Phytoestrogens

Phytoestrogens are naturally-occurring chemicals that are found in plant foods ("phyto" = plant). There are two main types of phytoestrogens: the *isoflavones*, which include genistein and daidzein, and the *lignans*, which include secoisolariciresinol and matairesinol. The isoflavones are generally absorbed in the body as is, and can be detected in urine. The lignans, however, are usually broken down to enterolactone and enterodiol before being absorbed.

How People Are Exposed to Phytoestrogens

People are most commonly exposed to phytoestrogens through diet. Whole grains, seeds and other plant foods are sources of lignans. Particularly rich sources include whole rye and flax seeds. Other foods, including vegetables and fruits, may also provide some lignans in the diet. Legumes, especially soy beans, are rich sources of isoflavones. Soy foods such as tofu or soy milk also contain substantial amounts of isoflavones. Because of the interest in isoflavones, it is possible to find food sources enriched with soy protein and soy flour.

How Phytoestrogens Affect People's Health

The human health effects from exposure to phytoestrogens are unknown. They have weak hormonal (estrogenic) activity in test systems, like the other chemicals we are measuring. However, unlike the other chemicals that are man-made, phytoestrogens are found naturally in the diet.

Because phytoestrogens have hormonal (estrogenic) effects, there has been concern that they may affect normal hormonal processes and disease processes that are influenced by hormones in the body. When there are high levels of the body's own estrogens, such as before menopause, phytoestrogens may interfere with hormonal activity. If there are low levels of the body's own estrogens, such as after menopause, phytoestrogens may act as estrogens and increase hormonal activity. There have been a number of studies that have looked at whether phytoestrogens or their food sources such as soy foods may affect risk of hormone-dependent cancers such as breast cancer or prostate cancer. Overall, these studies suggest that phytoestrogens or soy foods may lower the risk of these cancers. Other studies have demonstrated that genistein has a number of effects, such as preventing the formation of new blood vessels (anti-angiogenesis), or preventing cell-replication (as a tyrosine kinase inhibitor). Whether these are important in risk of cancer or other diseases are less clear. The FDA has approved a health claim indicating that regular consumption of soy protein in the context of a low saturated fat and cholesterol diet can lower heart disease risk by modestly lowering blood cholesterol levels. Whether the phytoestrogen content of soy protein contributes to this effect is not clear.

Levels of Phytoestrogens in the U.S. Population

Because foods rich in phytoestrogens are eaten at low levels in the U.S., phytoestrogen intake is substantially lower than, for example, Asian countries, where soy foods are a mainstay in the diet. When measured as urinary excretion levels, isoflavone levels are in U.S. populations are as much as 50 times lower than in Asian populations. This likely reflects regular consumption of traditional soyfoods in Asia, and the general low levels of soy intake in the U.S. The levels found in NHANES analyses are similar to those found in other studies in the U.S. and Europe.

The concentrations of urinary phytoestrogens observed in the NHANES 1999–2000, 2000–2001, and 2003–2004 subsamples generally reflect a diet consumed in the U.S. that is lower in isoflavones than in lignans. This is consistent with a Western diet in which whole grains and cereals, rather than soybean products, contribute the bulk of phytoestrogens (CDC, 2009). Enterolactone levels were highest, followed by daidzein, enterodiol, genistein, equol, and O-desmethylangolensin. Isoflavone levels at the higher percentiles may reflect regular soy intake or supplementation.

CDC scientists found detectable levels of phytoestrogens in a randomly selected subset of urine and serum samples from the general public (Valentin-Blasini et al., 2003). The highest levels were detected in urine samples compared to serum samples. The highest urinary levels were found for enterolactone, daidzen, and genistein. Levels of phytoestrogens in the body were higher in Whites, except for the lignan matairesinol, which was highest in Blacks.

Finding a measurable amount of one or more phytoestrogens metabolites in urine does not mean that the levels of the metabolites or the parent phytoestrogen may cause an adverse health effect. Biomonitoring studies on the levels of phytoestrogen metabolites provide physicians and public health officials with reference values so that they can determine whether people have been exposed to higher levels of phytoestrogens than those found in the general population. Biomonitoring data can also help scientists plan and conduct research on exposure and health effects.

For More Information

- http://www.cdc.gov/ExposureReport/data_tables/Phytoestrogens_ChemicalInformation.html
- Valentin-Blasini L, Blount B, Caudill S, ,Needham L. Urinary and serum concentrations of seven phytoestrogens in a human reference population subset. J Expos Anal Environ Epidemiol. 2003;13:276-282.
- Centers for Disease Control and Prevention (CDC). Fourth National Report on Human Exposure to Environmental Chemicals. Atlanta (GA). 2009.

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