



Soyfoods and the Endocrine System

Key Points

- The endocrine system regulates various physiological functions including metabolism, growth, sexual function and development.
- The effect of soyfoods on the endocrine system has received a great deal of interest due to the presence of isoflavones in soybeans.
- Isoflavones have structural similarities to the female hormone estrogen but the effects are clearly different from estrogen; they have been described as natural selective estrogen receptor modulators (SERMs) that possess both estrogen-like and anti-estrogenic properties.
- Findings from animal and test-tube studies have raised concerns that isoflavones may adversely impact the endocrine system
- The results from animal studies often poorly predict effects in humans
- A wealth of human data indicates that isoflavones found in soy do not cause adverse effects on female or male hormone levels, fertility, breast cancer risk or thyroid function in healthy individuals. Due to the large amount of evidence suggesting that soy has potential health benefits, these foods should be part of an overall healthy diet

Introduction

The endocrine system is made up of a number of glands that produce and secrete hormones into the bloodstream. These hormones regulate various physiological functions including metabolism, growth, sexual function and development. Anything that can alter the function of the endocrine system may consequently have an impact on an individual's health. The effect of soyfoods on the endocrine system has received a great deal of interest mainly because soybeans are a source of isoflavones. Isoflavones belong to a group of compounds called phytoestrogens which show structural similarities to the female hormone estrogen and therefore may exert weak estrogenic-like effects. This property raised concerns that isoflavones may affect the endocrine system. To better understand this topic it's important to have an accurate understanding of isoflavones.

What are Isoflavones?

Soybeans are a uniquely rich source of isoflavones, with the three isoflavones in soy being genistein, daidzein and glycitein. Although they have structural similarities to estrogen, isoflavones clearly differ from estrogen.

Soy isoflavones are natural selective estrogen receptor modulators (SERMs). SERMs have tissue selective effects in that they exert estrogenic effects in some tissues, anti-estrogenic effects in others while they may not exert any effect at all in others. SERMs are designed to have some of the benefits of estrogen without the side effects of this hormone. Nevertheless this, isoflavones have also been inaccurately described as endocrine disruptors. Endocrine disruptors are defined as naturally occurring compounds, or synthetic chemicals, that interfere with the production or activity of the hormones of the endocrine system resulting in adverse health effects. However, much of the work investigating the effects of isoflavones in this area has been undertaken in animals. Results from animal studies often poorly predict what will happen in humans.

Animals metabolise isoflavones very differently to humans which makes extrapolating the results from animal studies to humans difficult. Firstly, in comparison to humans, all rodents and monkeys are very efficient at converting the isoflavone daidzein into the more potent isoflavone called equol. Secondly, compared to animals, humans are very efficient at metabolising isoflavones to a less biologically active form. Consequently animals have higher circulating levels of biologically active isoflavones. Furthermore, often in animal studies high doses of purified isoflavones or isoflavone mixtures are used. These products do not reflect soy in itself nor do they reflect normal concentrations of these bioactive compounds in soyfoods. Importantly, soybeans contain many other biologically active substances which may have health effects in their own right, or which may act together with the isoflavones to bring about positive health outcomes. For these reasons when considering the effects of soyfoods, judgements should be made based on human clinical studies.

Isoflavones and Female Hormones

The vast majority of human studies show no changes in reproductive hormone levels following soyfood or isoflavone consumption in postmenopausal women. In studies of premenopausal women, soy and/or isoflavone intake has been associated with a slightly longer menstrual cycle (1 day) and slightly lower levels of follicle stimulating hormone (FSH) and luteinizing hormone (LH). The clinical effect of these changes is unclear, although the subtle reductions in FSH and LH do not have an impact on ovulation and fertility. No ovulatory or fertility problems have been associated





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with soyfood consumption in women in Asian countries where soyfoods are an important part of the diet. Furthermore, the increased menstrual cycle length may be beneficial in the long term, as it has been suggested that an increased menstrual cycle length is associated with a reduced risk of breast cancer.

As lifelong exposure to estrogen is associated with an increased risk of breast cancer, concern has been raised that isoflavones may be harmful to breast cancer patients and women at high risk of developing breast cancer. However, this fear appears to be unjustified. A large number of human studies have found that soy isoflavones do not adversely affect breast tissue. In those women who have had breast cancer, evidence suggests that not only is soy safe to eat but that it may even be beneficial to this group of women.



Moreover there is a large amount of evidence indicating soy is actually associated with a reduced risk of developing breast cancer. It appears that the critical period during which soy seems to exert its protective effects is during the early years. It's thought that exposing breast cells to isoflavones during this period makes them less likely to be transformed into cancer cells later in life. Indeed there is impressive evidence from population studies suggesting that consuming very modest amounts of soya (such as one serving of soy milk per day) during the early years reduces breast cancer risk by as much as 25 to 50%.

Isoflavones, Male Hormones and Fertility

The estrogen-like effects of isoflavones have raised concerns that soyfoods may affect male hormone levels and fertility. This however, is not supported by evidence from human studies. Findings from 32 trials did not reveal any effect of isoflavones on male reproductive hormones. In addition, 3 clinical studies found no effect of soyfoods or isoflavone supplements on sperm concentration or semen quality. Even at relatively high doses of isoflavones, 12 times higher than the typical Japanese intake, there was no effect on these parameters.

Isoflavones and Thyroid Function

Concerns about possible anti-thyroid effects of soy are based on animal and test-tube studies. However human studies have found that isoflavones do not alter thyroid function in healthy individuals.

The effects of isoflavones on thyroid status in patients with subclinical hypothyroidism (defined as having normal levels of thyroid hormones, but elevated levels of thyroid stimulating hormone (the hormone which stimulates the thyroid gland to secrete the hormones thyroxine and triiodothyronine), requires further research.



Conclusions

- Soyfoods are a good source of isoflavones.
- Isoflavones belong to a group of natural plant compounds called phytoestrogens which have structural similarities to the female hormone estrogen.
- Based on results from animal and test-tube studies, unjustified concerns have been raised suggesting that isoflavones may alter the function of parts of the endocrine system. However interpreting results from animal studies is problematic and there is a wealth of human data indicating that isoflavones in soyfoods do not result in adverse health effects in healthy adults.
- Soyfoods should be recommended as part of a balanced diet due to the large amount of evidence highlighting soy's potential health benefits.

Interested? Have a look on www.ensa-eu.org for more details and references or contact us via secretariat@ensa-eu.org

