

# *Differentiating Between* **PLANT PHYTOESTROGENS** *and ESTROGEN* ( ISOFLAVONES )

<b>EFFECTS ON:</b>	<b>BREAST TISSUE</b>	<b>ENDOMETRIAL TISSUE</b>	<b>HORMONE LEVELS IN WOMEN</b>
<b>SPERM AND SEMEN</b>	<b>HORMONE LEVELS IN MEN</b>	<b>MUSCLE MASS AND STRENGTH</b>	

**Soyfoods do not contain human estrogen. Soybean isoflavones are not the same as human estrogen.**

## **Estrogen**

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Hormones are chemical messengers produced by the body that cause tissues to behave in a certain way. For hormones to exert effects they need to bind to and activate receptors in cells.

Estrogen is referred to as the female sex hormone. It is primarily produced by the ovaries and travels in the bloodstream to interact with tissues.

Estrogen is crucial to the reproductive function and menstrual cycle of a woman. In premenopausal women, estrogen levels rise suddenly halfway through the cycle, which triggers the release of an egg. This level then quickly decreases after ovulation.

Estrogen is also responsible for the growth of breasts during adolescence. Other functions include helping to preserve bone strength and improving the thickness and quality of the skin. After menopause, the ovaries produce very little estrogen, so blood estrogen levels markedly decrease. That which is present in the blood comes mainly from estrogen production in fat tissue.

Despite its designation as the female sex hormone, men also produce estrogen. Estrogen in males is secreted by the adrenal glands and by the testes. Although throughout much of life estrogen levels are higher in women than men, blood estrogen levels in older men are actually higher than levels in older women.<sup>1</sup>

## Isoflavones (phytoestrogens)

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Isoflavones are naturally occurring compounds widely found within the plant kingdom and especially in legumes. However, among commonly consumed foods, soybeans and most foods made from soybeans are uniquely rich sources.<sup>2</sup>

Isoflavones serve two roles in plants. They are defense molecules; that is, isoflavones ward off disease-causing pathogenic fungi and other microbes.<sup>3</sup> In addition, the soybean uses isoflavones to stimulate soil-microbe rhizobium to form nitrogen-fixing root nodules.<sup>4</sup> Nitrogen fixation is the process by which molecular nitrogen in the air is converted into ammonia, which can be used by the plant to make compounds it requires for its survival, such as amino acids.



Isoflavones have been rigorously studied by health scientists over the past 30 years when the U.S. National Cancer Institute first expressed interest in understanding the role isoflavones in cancer prevention and treatment.<sup>5</sup>

Isoflavones have similar chemical structure to estrogen and are classified as plant estrogens because in certain situations, they exert effects similar to the hormone estrogen. However, isoflavones are very different from estrogen.

It is not unusual for compounds with similar chemical structures to have very different effects. For example, cholesterol and phytosterols have almost identical structures and yet the former modestly raises blood cholesterol<sup>6</sup> whereas the latter lower it.<sup>7</sup>

## Interaction with Estrogen Receptors

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There are two receptors in cells to which estrogen binds – estrogen receptor alpha (ER-alpha) and estrogen receptor beta (ER-beta). The binding of estrogen to these receptors triggers a cascade of reactions within the cell that affects function. Estrogen has equal affinity for both receptors.

Isoflavones also bind to both estrogen receptors but in contrast to estrogen, preferentially bind to and activate ER-beta.<sup>8</sup> This difference in binding preference between estrogen and isoflavones is important because when activated, ER-alpha and ER-beta can have very different and even opposite effects on cells.<sup>9</sup> Compounds that specifically target ER-beta are viewed as potential anti-cancer agents.<sup>10,11</sup>

## EFFECTS ON:

### Breast Tissue

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Use of estrogen therapy has been associated with an increased proliferation of cells in the breast, which can increase risk of breast cancer.<sup>12</sup> Clinical studies show that isoflavones do not stimulate breast cell proliferation in women<sup>13-18</sup> and population studies show exposure to isoflavones has either a neutral effect on breast cancer risk or is protective against this disease.<sup>19,20</sup>



### Endometrial Tissue

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In women, estrogen stimulates the proliferation of cells in the endometrium (lining the uterus), which can increase risk of endometrial cancer.<sup>21</sup> Isoflavones do not stimulate endometrial cell proliferation in women<sup>22</sup> and population studies show isoflavone exposure is associated with a decrease in endometrial cancer risk.<sup>23</sup>

### Hormone Levels in Women

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Estrogen therapy increases blood estrogen levels.<sup>24</sup> Isoflavones do not affect levels of estrogen in the blood.<sup>25</sup>

### Sperm and Semen

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Research shows that in men estrogen reduced sperm motility and sperm density.<sup>26</sup> Clinical studies show that isoflavones do not affect sperm or semen.<sup>27,28</sup>

### Hormone Levels in Men

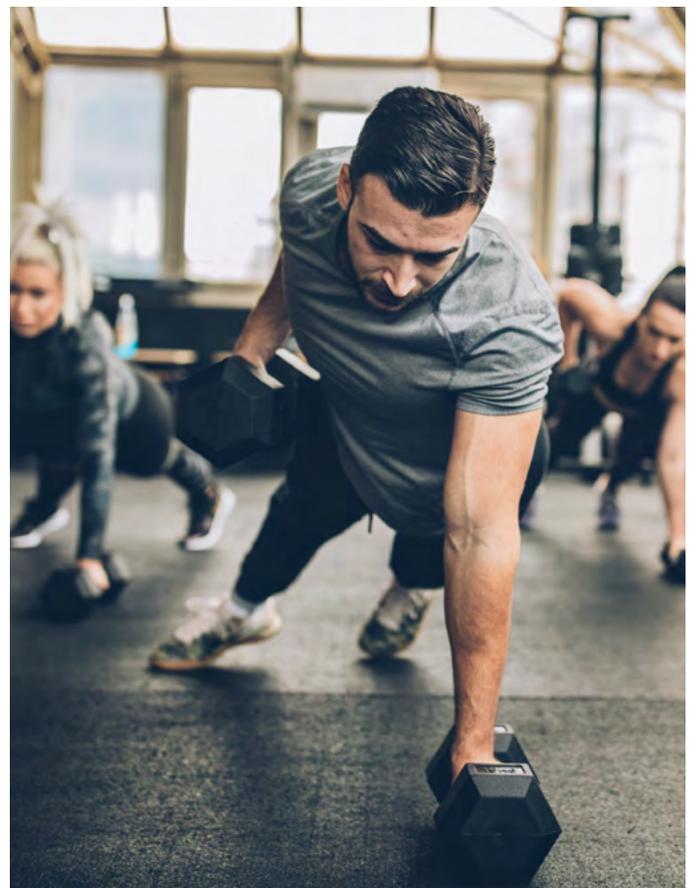
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Isoflavones do not increase blood estrogen levels<sup>29</sup> or lower testosterone levels.<sup>30</sup>

### Muscle Mass and Strength

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Supplementation with soy protein rich in isoflavones leads to increases in muscle mass and strength in individuals engaged in resistance exercise training, such as weightlifting, to the same extent as supplementation with animal protein including whey protein.<sup>31</sup>



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