

## Phytoestrogens in the canine diet: Do they affect fertility?

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Phytoestrogens are a type of flavonoid, a specific non-steroidal plant compound, that have estrogenic effects. The major plant containing these compounds found in the human and canine diet is soy bean, with free-daidzein, genistein and glycitein being the components of the plant with the highest estrogenic effects. Over the past decade there has been growing concern over the effect of phytoestrogens on human and canine health, specifically reproductive health. The majority of research concerning the effects of diets high in soy have focused on human health, with minimal studies in the canine population.

Human studies have shown that with moderate soy intake flavonoids act to modulate estrogen receptors and do not as strongly mimic the effect of estrogen directly (Zaheer 2017). Due to this receptor modulation, incorporating moderate amounts of soy into the diet may reduce the risk of cardiovascular disease, diabetes and osteoporosis. Flavonoids may also help lower cholesterol. The antioxidant properties of flavonoids and the direct effects of these compounds on enzymes that transcribe DNA, may help reduce the risk for certain cancers including breast cancer and prostate cancer (Zaheer 2017, Kuriyama 2013, Dagdemir 2013, Mahmoud 2014).

Along with the mounting evidence to support the health benefits of diets high in soy, there are several studies that suggest these phytoestrogens may have a detrimental effect on reproductive development and overall reproductive health. Many of these studies are difficult to interpret due to variability between individual subjects in absorption of phytoestrogens from the gastrointestinal tract, small sample sizes and lack of long term follow up.

In human infants fed soy-based formula there is no conclusive evidence to support that exposure to phytoestrogens has a deleterious effect on reproductive health later in life, however a review panel formed by the National Institute of Environmental Health Sciences has not issued a conclusive statement on the safety of soy based infant formula due to lack of scientific evidence (Cederroth 2012). Hooper et al. in a 2009 review, concluded that in adult women high soy intake was associated with lower levels of LH and FSH, both are hormones involved in normal reproductive cyclicity and ovulation. The actual significance of this finding is still unclear. In multiple studies, female mice fed pure extracts of phytoestrogens showed decreased fertility including; abnormal cycle length, abnormal ovarian and uterine development and poor pregnancy outcomes (Cederroth 2012). It is difficult, due to the species difference and the difference in level of exposure, to determine if these studies have any application to human and canine patients. In men there is lack of evidence to support any deleterious effects from soy consumption, although several poorly designed studies reported a decrease in sperm numbers with high soy intake (Cederroth 2012). In rodents and other animal species, most studies report no effect from soy intake on male fertility (Cederroth 2012). Two studies evaluating long term exposure in male rodents reported a decrease in litter size with life long exposure to phytoestrogens (Cederroth 2012).

Studies specifically pertaining to canine patients are very limited. In a 2004 study Cerundolo et al. measured the concentration of phytoestrogens found in 24 commercial dog

foods. Only those foods listing soy as an ingredient contained any detectable levels of phytoestrogens; foods containing only soy fiber did not contain measurable levels of phytoestrogens. In a related study Cerundolo et al. 2009 compared behavior, coat quality, blood profiles, thyroid values and steroid hormone concentrations in dogs fed diets high in isoflavones vs. diets low in isoflavones over the course of one year. The only statically significant difference observed between these groups was a slightly higher estradiol concentration in dogs fed the diet high in isoflavones. These were not breeding animals and the study took place over a relatively short time period, so the significance of this slight increase in estradiol is unknown. In intact male dogs Perez-Rivero et al. used a purified form of the phytoestrogen coumestrol fed at extremely high concentrations to induce testicular atrophy. While this study suggests an interesting method of population control in stray dogs, it in no way mimics the effect of feeding a commercial dog food containing soy.

Overall there is limited evidence to support that the elimination of soy from the canine or human diet would have beneficial effects on overall health or fertility. In the human population there is more compelling evidence to support the beneficial effects of including soy in the diet, than evidence to support any negative effects. There have been no canine specific studies evaluating the effect of feeding diets containing soy on reproductive parameters in breeding animals, it is therefore a challenge for veterinarians to make educated recommendations on the best commercial diets to feed breeding canines. It is important not to overlook the potential beneficial health effects of including soy in the diet when choosing a commercial food for any dog. Overall, based on information in the human literature, it may be best to avoid feeding diets high in soy to pregnant bitches and neonates until further information is available on the long-term effect of phytoestrogens on reproductive performance. In breeding animals experiencing fertility issues, it is good practice to evaluate all components of the patient's diet, including supplements, to eliminate any ingredients, including soy and other legumes that may negatively impact reproductive performance.

## References

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