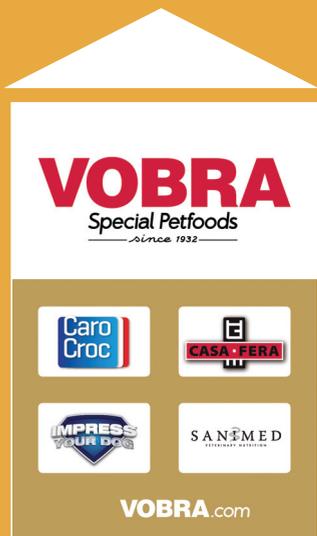




Dr A C Beynen was professor of veterinary nutrition at the Faculty of Veterinary Medicine, Utrecht University, The Netherlands in the period of 1993-2007.



Soyestrogens in petfoods

Phytoestrogens are naturally occurring plant (phyto) chemicals that are quite close to estrogens, the female sex hormones. Isoflavones represent a class of phytoestrogens that are found abundantly in soybeans. Soy as protein source in dog and cat food is often rejected because the accompanying isoflavones are believed to trigger abnormal puberty and infertility. Some petfood manufacturers advertise “no soy” formulas to meet the concerns and drive more sales.

Isoflavone contents vary among cat and dog foods. The range for canned and kibbled foods is similar when both product types are completely dried and then analysed. Cat foods contain 0 to 300 mg isoflavones (per kg dry weight), whereas the extent is 0 to 1200 mg for dog foods. Isoflavones are low or undetectable in diets that do not declare soybean-related ingredients, such as soybean meal, flour or hulls, or soy protein. Soybean oil and lecithin are devoid of isoflavones.

Isoflavones taken in by the body of dogs and cats are converted during cell processes, resulting in detoxification and removal with urine and feces. A toxicity study that lasted 90 days supports that a diet containing as much as 1250 mg (per kg dry weight) of a major isoflavone (genistein), will not elicit negative effects in dogs. In cats, the isoflavone had no adverse effects on general health at a dose similar to 6000 mg (per kg dry dietary weight).

The amounts of isoflavones in soy-containing petfoods appear to be safe as they do not cause visible abnormalities. At the same time, though, these foods can influence hormonal systems in dogs and cats. The observations so far connect isoflavone intake with thyroid function and female reproduction. It is unknown whether the isoflavones in soy-containing foods have a positive or negative impact on pets' fertility and/or longer-term health outcomes.

Phytoestrogens

Phytoestrogens are classified as flavonoids (flavones, flavanones and isoflavones), coumestans and lignans. Soybeans are rich in the isoflavones daidzein, genistein and glycitein. Their structures share a nucleus of three 6-atom rings: an oxygen heterocycle fused to one phenolic and bound to the other. Isoflavones occur predominantly as glycosides in plants and consequently are water soluble.

Isoflavone exposure

The amounts of genistein and daidzein in the same commercial petfood are generally comparable (1, 2). The sum of both ranged from 0 to 300 ppm (mg/kg dietary dry matter, throughout this text) in 101 moist and 79 dry cat foods. Glycitein, biochanin A and formononetin contents were relatively low (1, 2). Eight wet and 16 dry dog foods covered 0 to 1200 ppm genistein plus daidzein (3). Overall, higher isoflavone levels were associated with soy ingredients, regardless of food type.

Metabolism

Isoflavones reaching the intestinal lumen are hydrolysed by microbial glycosidases. The aglycons released can be absorbed or transformed. Equol, a gut microbiome



metabolite of daidzein, was found in cat blood plasma (4) and urine (5). About 30% of orally administered, pure genistein, was absorbed by cats (6) and 5% excreted in urine (7). Biliary secretion probably is the major route for elimination of isoflavones.

Absorbed isoflavones may be conjugated in the intestinal wall and/or liver. Glucuronidation enables urinary and biliary elimination of isoflavones in dogs, whereas in cats it is sulfation. Dog versus cat liver microsomes have greater glucuronidation activity, which explains that dog urine contained a higher fraction of glucuronidated genistein plus daidzein (5). In cat blood plasma, genistein and daidzein are virtually sulfated (4).

High-dose effects

For 52 weeks, beagle dogs (4/sex/group) received capsulated genistein at doses equivalent to 0, 1250, 3750 or 12500 ppm in the diet (8). Treatments were well tolerated with no overt signs of toxicity. Weight gain and blood test results were unaffected. The highest genistein dose increased uterus weight and decreased ovary or testes weight. The second highest dose also lowered ovarian weight. The amount equaling 1250 ppm dietary genistein did not cause aberrances.

Surgically neutered female and male cats were given genistein orally at an

experimental, pharmacological dose (100 mg/kg body weight/day). This dose, which is similar to 6000 ppm dietary genistein, reduced food intake (9), enlarged lean body mass (10) and affected leukocytes (11). In the ovariectomized cats, the vaginal epithelium responded to genistein (9, 10). Visible health of the cats was unaffected.

Field-realistic-dose effects

Dogs fed a dry diet containing hydrolysed soy isolate (96 ppm genistein + daidzein; aggregated as from here) instead of an alcohol-extracted isolate (7 ppm) for one year had higher serum concentrations of thyroxine and post-ACTH oestradiol (12). After six months, dietary inclusion of soybean meal (117, 213 and 330 ppm) tended to enlarge lean body mass in dogs (13).

A cross-over cat study with three-month periods, using balanced diets with (380 ppm) or without (34 ppm) soy ingredients, showed that soy slightly, but significantly, raised serum thyroxine concentration (14). Cats were fed a diet without or with added genistein plus daidzein (300 ppm) from weaning until 15 or 18 months of age. Isoflavone consumption upregulated estrogen receptors in the reproductive tract (15) and increased the incidence of spontaneous ovulation (16).

Isoflavones in soy-containing petfoods likely influence the body's endocrine system. In the related studies (12-16), general health of the dogs and cats was uncompromised. Long-term effects, whether negative and/or positive, might occur.

List of references is available on request from the author (beynen@freeler.nl)

* Dr Anton C Beynen writes this exclusive column on dog and cat nutrition every month. He is affiliated with Vobra Special Petfoods.

