

Alternative Proteins in Pet Nutrition:

Advantages of Including Insect Ingredients in Diets for Dogs and Cats

Insects have a long history as food items, including consumption by dogs and cats. Wild wolf diets contained small amounts of insects, and domestic cats hunt and consume insects at up to 8% of their total dry matter intake (Bosch et al., 2020). Insects are routinely fed to a variety of exotic animals to support their natural feeding behaviors, and the use of insects as bait is commonplace. While the list of insect species used for these purposes is quite extensive, the most common include black soldier fly larvae (*Hermetia illucens*), true crickets (*Gryllidae*), yellow mealworms (*Tenebrio molitor*), and superworms (*Zophobas morio*). With the exception of superworms, these are also the most common insect species being reared commercially.

Black Soldier Fly Larvae

Black soldier fly larvae (BSFL) have gained considerable attention in the last few years, due to the massive potential for protein production by these insects. In fact, BSFL have the potential to produce up to 7.9 kg of protein per m² annually (Koutsos et al., 2019), significantly greater than traditional protein sources. Additionally, BSFL have

tremendous flexibility in the diet items that they can be fed, thus allowing for very efficient upcycling of locally sourced by-products from the food and feed industry into premium quality protein and energy sources. However, it's important to note that the nutritional composition of the larvae can change in response to different diets, therefore a solid understanding of the feeding program and resulting nutrient composition of BSFL-derived ingredients is critical to ensure reliable nutrition in a complete dog or cat food.

Crickets

Crickets are part of the most diverse group of insects consumed worldwide. At least 80 known species of crickets, grasshoppers, and locusts are consumed as part of human diets across Africa, South America, and Southeast Asia (Makkar et al., 2014). With feed inputs considered, crickets have the potential to produce up to 2.2 kg of protein per m² annually (Koutsos et al., 2019).

Mealworms

Yellow mealworms, the larval stage of the darkling beetle, are native to Europe, but can now be found worldwide (Eriksson et

al., 2020; Makkar et al., 2014). With feed inputs considered, mealworms have potential to produce up to 4.1 kg of protein per m² annually (Koutsos et al., 2019).

Benefits of Insects in Pet Food

Nutritional Benefits and Palatability

BSFL ingredients provide good quality nutrition for dogs and cats. In dogs, BSFL oil (up to 5% of the diet, externally applied), and BSFL meal (up to 20% of the diet) were an effective replacement for poultry fat and/or poultry by-product meal, with similar diet consumption, digestibility and stool quality (Freel et al., 2021). At lower levels of inclusion, BSFL meal (1 or 2% inclusion) significantly improved dry matter and nitrogen digestibility compared to a control diet (Lei et al. 2019). A similar trend was demonstrated in dogs fed BSFL meal or venison, with dogs fed BSFL as the primary protein source in a hypoallergenic diet having significantly higher protein and calcium digestibility (Penazzi et al., 2021). Dogs fed up to 24% cricket meal also maintained good intake and had no changes in gut microbial diversity as compared to chicken-based diets (Jarett et al., 2019)

Digestibility studies with cats have also demonstrated promising results. In a recent trial, adult cats were fed wet diets containing whole BSFL (5% inclusion), BSFL

meal (10% inclusion) or BSFL oil (1.5% inclusion) replacing poultry by-product meal and/or poultry fat. Cats fed the BSFL ingredients maintained good stool quality and normal blood chemistry profiles. In fact, cats fed BSFL ingredients had significantly greater intake as compared to those fed poultry-derived ingredients (Do et al., 2022).

Cats have also been shown to consume diets containing up to 15% of (cockroach [*Nauphoeta cinerea* or *Gromphadorhina portentosa*] or superworms with no change in apparent total tract digestibility of dry matter, organic matter, crude protein, and metabolizable energy, or in the fecal concentrations of short-chain and branch-chain fatty acids, and gut microbial diversity and richness (Reilly et al., 2022).

Contributions to Sustainable Pet Food Options

Insects present an opportunity to incorporate more sustainable ingredients into pet foods. Overall, insects tend to be more sustainable producers of quality nutrition than livestock or plant protein sources, because they require significantly less land, water, and feed to produce high quality nutrition. Less resource input into production results in less greenhouse gas (GHG) emissions. Overall global warming

potential (kg CO₂ equivalent/kg edible protein) of mealworms was reported to be 1.4 to 2.6-fold lower than that of chicken (Do et al., 2020). Life cycle assessment of BSFL production has demonstrated similar results (Parodi et al., 2020).

In addition to their need for less land, water and feed than other protein production systems, insects (particularly BSFL) can utilize a very wide range of feed ingredients and are very effective at utilizing by-products that may otherwise have lower nutritional value or be destined for a landfill (Heidari-Parsa et al., 2018; Makkar et al., 2014). Thus, insects can participate in the circular economy of agricultural systems and help global agriculture become even more efficient and sustainable. Of course, insect producers must carefully select their diet inputs to ensure safety and regulatory compliance in their given geographical area and for the desired application in livestock feed and pet food.

Value Added Benefits

The inclusion of insect ingredients in pet diets may provide benefits in addition to high quality nutrition. Current research suggests that insect-derived ingredients may be an effective hypoallergenic protein source, since they represent a novel protein to most dogs and cats (Bosch & Swanson, 2020). Second, the chitin component of

insect ingredients (from the exoskeleton of the insect) may act as a fermentable fiber source and thus promote gut health (Jarett et al., 2019). Finally, recent data suggests that insect ingredients may promote anti-inflammatory and anti-oxidative properties (Lei et al., 2019). Low inclusion levels of BSFL meal (1 or 2%) were associated with higher levels of anti-inflammatory and anti-oxidative markers including glutathione peroxidase, and superoxide dismutase, and dogs challenged with a simulated *E. coli* infection had a faster return to baseline conditions (Lei et al., 2019). These results are very promising, and insect derived ingredients may thus promote well-being and optimized immune responses in our beloved companion animals.

EnviroFlight® Products

In the United States, black soldier fly larvae (BSFL) are AAFCO-defined for use in salmonids, poultry, swine, and wild birds, (whole dried BSFL and BSFL meal) and for finfish, swine and adult dogs (BSFL oil).

As the first US commercial scale BSFL production facility, EnviroFlight® prides itself on using consistent, wholesome by-products that are locally and regionally sourced, to create high quality and consistent BSFL-derived ingredients, including EnviroBug – whole dried black

soldier fly larvae, EnviroMeal – high protein BSFL meal, and EnviroOil – BSFL oil. EnviroFlight® processes are first tested in our dedicated research and development facility and with our trusted academic and industry partners, before implementation in our commercial-scale production facility,

so you can be sure our processes are tried and true in the USA!

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