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Insect-based petfood

In Europe, at least 12 insect-based, complete dry dog foods are marketed. The first one was launched in 2015 (1). The foods traceably contain preparations of black-soldier fly larvae or yellow meal worms, but their ingredient lists often leave the insect species unnamed. All 12 foods are positioned as hypoallergenic, while 8 of them also highlight insects' sustainability. The array comes along with one canned product and two dry cat foods.

Insects purportedly carry novel, previously uneaten protein which minimizes the risk to an allergenic response. However, all petfoods unavoidably and legally have small amounts of insect matter. Cats with outdoor access catch insects as prey. Treats with various insect species are increasingly hitting the market. The efficacy of insect-based petfood in treating true food allergy is unknown, but equally the condition is uncommon, implying little need for hypoallergenic foods (2).

Insect protein is claimed to be sustainable. In terms of global warming potential, the farming of insects is less harmful than that of meat chickens, but more so than crop production. On average, the 12 insect-based dry foods contain about 20% insect preparation, while 9 foods also contain other animal-derived ingredients. Not only does complete vegetarian petfood (3) exclude meat-animal exploitation, but it also is eco-friendlier than insect-based petfoods.

There is limited published information on insects as petfood component. Protein quality and digestibility of black-soldier fly larvae and yellow meal worms are adequate. Foods with the insect sources are consumed willingly. Short-term feeding tests did not elicit negative effects on visible health of dogs and cats. Apparently, practical use of insect-based foods is without adverse events, but long-term safety awaits confirmation.

Composition

Whole larvae of the black-soldier fly (*Hermetia illucens*) and the yellow-mealworm beetle (*Tenebrio molitor*), or BSFL and YMW for short, have variable compositions. The crude protein and fat contents are 41 to 56 and 15 to 36 % in the dry matter (4-9). For puppies and kittens, the sum of methionine and cystine reflects the limiting amino acid in the two larvae species (6, 7). Lauric acid (C12:0) represents about 40% of total fatty acids in BSFL (5), but less than 0.2% in YMW (4).

Analysis of dried and partially defatted BSFL and YMW preparations used as petfood ingredients reveals around 60% crude protein, 15% crude fat and 10% crude fiber, but between-batch variation is considerable. Roughly half of the crude-fiber analyte could constitute chitin (5), but the N-acetylglucosamine polymer contributes little to the crude protein value.

Digestibility

In-vitro digestibility of protein in whole BSFL and YMW was 88.7 and 91.9% (6, 9), while the undigested residue appeared poorly fermentable by dog feces as microbiota source (9). Feces of dogs fed a BSFL-containing diet had increased chitin concentrations (10). For extruded foods with partially defatted BSFL or YMW, each accounting for about 30% of total dietary protein, apparent digestibilities of crude protein were 83.9 and 83.6% of intake in dogs and 79.8 and 80.4% in cats (11).

When dogs (12, 13) and cats (14) were switched to a formula with YMW as almost exclusive protein source, the owners did not note changes in feces consistency. For dogs fed commercial dry foods based on either lamb meal or BSFL, fecal scores differed statistically, but not meaningfully (10).

Palatability

Free-ranging wolves (15) and feral cats (16) consume insects, the latter on average 1 weight% of their diet. Insects not only make up almost 1% of the animals brought home by British domestic cats (17), but are eaten also (18). Dogs seem to enjoy eating live BSFL (19) and dried mealworms (20) and were equally attracted towards olfactory cues from either commercial dry food, dried whole BSFL or YMW (21). In two-bowl preference tests, the intake ratio of dry foods with BSFL or YMW was about 60:40 in dogs and 40:60 in cats (11). Changing over dogs and cats to BSFL- or YMW-based, dry foods went smoothly (11, 12-14).

Owner acceptance

Forty six out of 50 pet owners gave positive feedback after learning they had been feeding an insect-based diet. Negative feelings, due to insect phobia and safety concerns, would be dropped for veterinary-



prescribed diets with insects (22). Veterinarians seem interested in insect-based food as hypoallergenic alternative (23).

Safety

Insect-based, complete petfoods are on the market for up to three years. So far no health risks have been reported. YMW- and BSFL-containing diets did not negatively affect apparent pet health in studies lasting 28 (12-14) or 42 days (10), but clinical chemistry measurements were not done. An oral dose of 2.5 g cricket powder/kg bodyweight did not produce adverse effects in dogs (24).

The impact of insect consumption on health in the long term is unknown. Insects might hold toxicants, either self-synthesized or derived from their feed substrates.

Sustainability

When at the farm gate, YMW (25) and BSFL (26) have emitted less greenhouse gas per kg live weight than chicken, pork or beef (27), but more than one kg of corn (28) or soybean (29). The ranking could persist after the processing toward isonitrogenous, dry protein concentrates for use as petfood ingredients. However, fair comparisons require calculations that allow not only for transportation and processing, but also for land use (change), energy efficiency, water pollution, co-products and their applications.

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

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