Sustainable Fats and Oils in Pet Food – Exploring Alternatives for a Greener Future

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The Need for Sustainable Lipid Sources in Pet Food

Novel sustainable fats and oils are increasingly important in pet food production as demand grows for environmentally friendly and ethical alternatives. While traditional animal fats—particularly those from the rendering industry—already present relatively low environmental impacts, they may not be sufficient alone to meet the needs of a growing pet population. Alternative lipid sources such as **insects, algae, camelina oil and oils from agri-food by-products** offer promising complementary solutions. Rather than fully replacing animal fats, these novel sources can be integrated to diversify fat supply, reduce pressure on finite natural resources, and support a transition toward more sustainable development. As the global population rises and both people and pets require more protein and energy-dense foods, incorporating sustainable fats into pet food formulas is a strategic way to maintain nutritional quality while safeguarding planetary health.[1]

Insect Oils in Pet Food

Nowadays the main sources of insect oils and meals are the black soldier fly (BSF), the mealworm, the grasshopper and the cricket.

Table 1 shows the fatty acid profile of black soldier fly larvae, showing that it is rich in saturated fat and contains low levels of polyunsaturated fat. However, we can find in the market that the polyunsaturated fat content of BSF ingredients may have big variations among suppliers, from less than 1 to 15 %. At this point, it is known that these differences on the fatty acid composition of insect meals and oils from the same insect species may be due to the feeding. Indeed, it is **possible to modulate the nutritional composition with the feeding** the insects get. Thus, being possible to find insect ingredients which are high polyunsaturated and sensitive to oxidation, or which are more saturated and more stable.[2]

Table 1. compares the fatty acid profiles of traditional animal fats (chicken and pig) with insect-derived oils from BSF and crickets. BSF oil is exceptionally rich in **lauric acid (C12:0)**, a medium-chain fatty acid known for its antimicrobial properties and oxidative stability. Cricket oil, on the other hand, provides higher levels of **polyunsaturated fatty acids (PUFA)** such as **linoleic acid (C18:2 ω-6)** and **oleic acid (C18:1)**, which are beneficial for skin, coat, and immune health.

These profiles suggest that insect oils can **partially replace chicken and pork fat** in pet food formulations. However, insect oils **do not supply essential fatty acids** such as **arachidonic acid (C20:4 ω-6)** and **eicosapentaenoic acid (EPA, C20:5 ω-3)**, which are crucial for feline health and must be provided through other ingredients like fish oil or organ meats.

Incorporating insect oils offers a promising strategy to reduce environmental impact while maintaining nutritional and functional quality in pet food.

Table 1. Fatty acid profile of black soldier fly (BSF) larvae, cricket larvae, chicken and pork.

Fatty Acid	BSF Larvae[2,3]	Cricket Larvae[2,3]	Chicken[4]	Pork[4]
C-12:0	58*	< 1	< 1	1
C-14:0	8	< 1	< 1	1
C-16:0	10	26	25	24
C-18:0	1	< 1	8	13
C-16:1	2	< 1	3	2
C-18:1 Oleic	10	24	30	40
C-18:2 w-6	9	35	18	10
C-18:3 w-3	< 1	2	2	< 1
C-20:4 w-6	-	-	7	1

*Expressed in %

Plant and Algal Oils: Sustainable Omega-3 Sources

Table 2 compares the fatty acid profiles of **Schizochytrium sp. oil** (a marine microalga), **camelina oil** (a terrestrial oilseed plant), and two common **fish oils** (salmon and herring). It highlights the distinct nutritional characteristics of these lipid sources, especially in terms of omega-3 fatty acid content.

Camelina oil is rich in **alpha-linolenic acid (ALA, C18:3 ω-3)**, a short-chain omega-3 fatty acid, but contains no EPA or DHA (Docosahexaenoic Acid).

In contrast, Schizochytrium oil provides a **high level of DHA (41%)** and negligible EPA, making it a unique **vegan alternative to fish oil**. Fish oils from salmon and herring contain both **EPA and DHA** in moderate levels, but are also higher in saturated fatty acids (e.g., palmitic acid, C16:0). The comparison underlines the need to strategically **combine lipid sources** in pet food formulations to deliver the desired fatty acid profile. While camelina provides omega-3 precursors (ALA), dogs convert ALA to EPA and DHA **with limited efficiency**, and **cats are unable to perform this conversion**, requiring **preformed DHA and EPA** in the diet. This makes algal oils such as Schizochytrium particularly relevant in feline nutrition.

Table2. Fatty acid profile of Schizochytrium sp., camelina oil, salmon oil and herring oil.

Fatty Acid	Schizochytrium sp.[5]	Camelina[6]	Salmon[7]	Herring[7]
C-14:0	< 1	< 1	2	6
C-16:0	27	5	17	13
C-16:1	< 1	< 1	4	nd
C-18:0	2	2	3	1
C-18:1 Oleic	16	16	21	22
C-18:2 w-6	3	17	2	1
C-18:3 w-3	< 1	37	1	nd
C-18:4 w-3	nd	nd	2	2
C-20:5 EPA	< 1	< 1	5	5
C-22:6 DHA	41	-	17	6

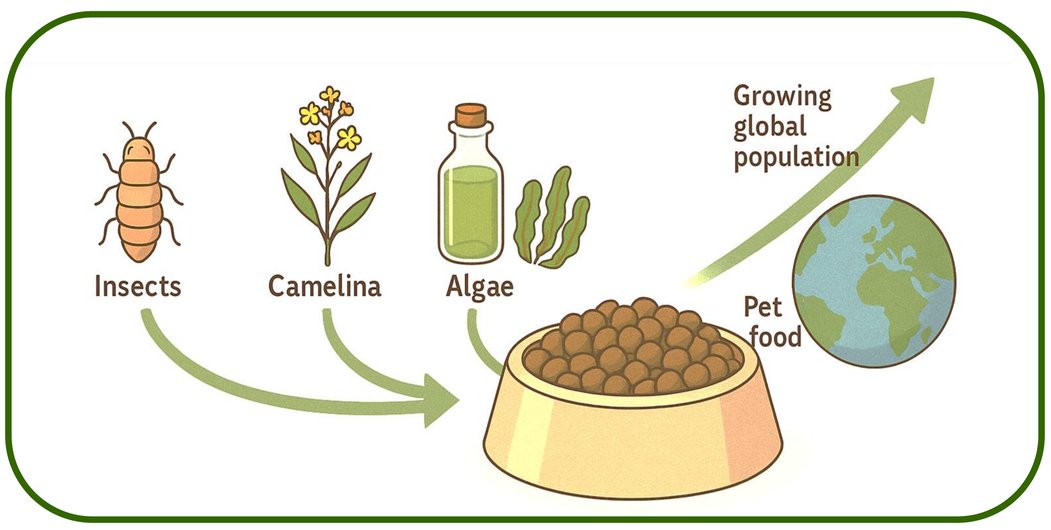

Figure 1. Integration of novel fat sources to complement traditional animal fats in pet food as a strategy toward sustainable development

Limitations and challenges

Camelina, insect, and algal oils offer sustainable alternatives to animal and fish fats in pet food, but each has limitations.

Camelina oil provides ALA (omega-3 precursor) but lacks EPA and DHA. While dogs can convert ALA with low efficiency, cats cannot, making camelina unsuitable as the sole omega-3 source for felines.

Insect oils are rich in saturated fats like lauric acid. Their fatty acid profile varies by substrate, and palatability and consumer acceptance can be challenges.

Algal oils (e.g. *Schizochytrium*) are excellent DHA sources but usually contain minimal EPA. They are more costly and sensitive to oxidation and may require stabilization in formulations.

Conclusion

Novel lipid sources such as camelina, insect oil, and algal oil can play a complementary role in pet nutrition, reducing dependence on conventional animal fats and fish oils. However, their effective use requires careful balancing to meet species-specific fatty acid requirements — particularly in cats, which need preformed EPA and DHA.

References

1) K. S. Swanson et al. "Nutritional sustainability of pet foods" *(Bethesda, Md.)* 2013, vol. 4,2 141-50; 2) R. H. Janssen et al. Nature Scientific Reports (2019) 9:2967; 3) A. A. Mariod, Springer Nature Switzerland AG 2020 (ISBN 978-3-030-32952-5). 4) F. Gunstone, Fatty Acid Composition of Some Common Fats, Fatty Acids and Lipids Chemistry, Blackie: London, 1996; 5) EFSA Journal 2020;18(10):6242; 6) A.N. Ostricov et al. The study of the fatty acid composition of camelina oil obtained by cold pressing, IOP Conf. Ser.: Earth Environ. Sci. (Bristol, UK) 2021, vol. 640(4):042009; 7) Pikova, J., Fish Oils, 2009; 515–526 : Howe, R.C., Bryden, W.L.., Lipids 2002; 11 : 1067–1076