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INSECTS IN FOOD/FEED SYSTEMS AND NUTRITION

Nutritional, functional and bioactive properties of protein isolates from edible insects for pet food applications

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The global pet food industry is undergoing rapid transformation driven by sustainability requirements, rising raw material costs, and increasing demand for nutritionally optimised and functional ingredients. Insect-derived proteins have gained significant attention as a sustainable alternative due to their efficient feed conversion, low environmental footprint, and high nutritional value, making them particularly attractive for premium and functional pet food formulations. Among insect-based ingredients, protein isolates offer improved functionality, and bioactive potential compared to whole insect meals. This study evaluated protein isolates (PI) obtained from *Acheta domesticus* (AD), *Tenebrio molitor* (TM), and *Zophobas morio* (ZM) for their applicability in pet food production. Insects were reared on wheat meal with carrots and cabbage, thermally inactivated, vacuum-dried at 70 °C, defatted with hexane, and subjected to alkaline extraction (pH 11) followed by isoelectric precipitation (pH 3). Lyophilized protein isolates were analysed for protein content (cf 5.6), amino acid composition, antioxidant activity, water- and oil-binding capacity, and antimicrobial activity. Enzymatic hydrolysis was performed to obtain protein hydrolysates (PH) and assess their bioactivity against *Escherichia coli* and *Staphylococcus epidermidis*. The highest protein content was observed in ZM PI (76.55%), followed by TM (45%) and AD (42%). Valine, leucine, isoleucine, and lysine were the dominant essential amino acids, while methionine was the limiting amino acid in all isolates. Aspartic and glutamic acids were the most abundant non-essential amino acids. All PI showed high antioxidant activity and contained low-molecular-weight proteins and peptides (<14 kDa) associated with bioactive functionality. Favourable water- and oil-binding capacities confirmed their suitability as functional pet food ingredients. Protein hydrolysates exhibited inhibitory effects against both bacterial strains, with stronger activity against *S. epidermidis*. In conclusion, insect protein isolates and their hydrolysates represent a promising sustainable and functional ingredient for the global pet food industry, while economic feasibility will determine their large-scale implementation. Acknowledgements: This research was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Nos: 451-03-136/2025-03/200222 and 451-03-136/2025-03/200134).