Black soldier fly: a new perspective as a functional and sustainable ingredient

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Introduction

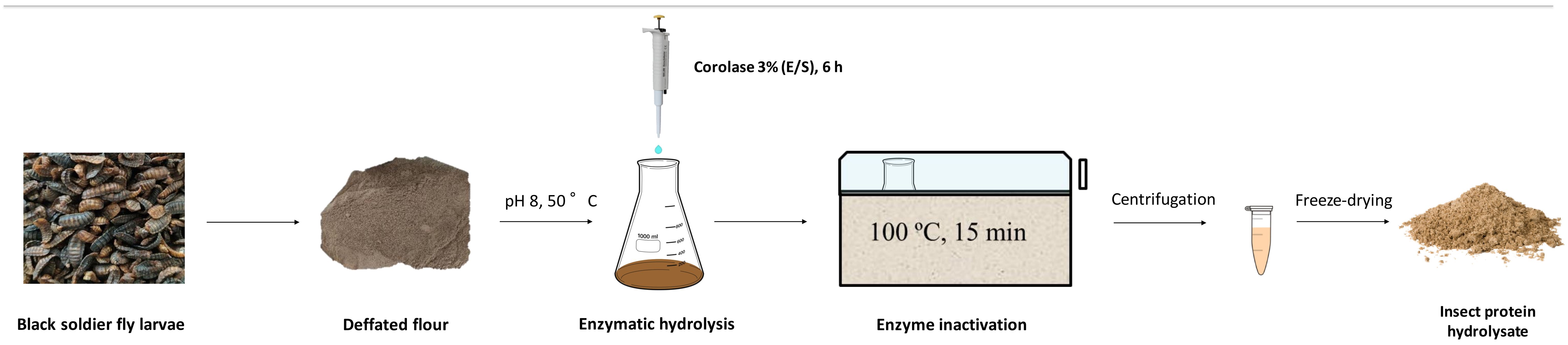
The world population has been expected by the Food and Agriculture Organization (FAO) of the United Nations to rise to over 9 billion by 2050, requiring an intensification in food production. While the increase in human population efforts the demand for food, there is a concomitant decrease in accessible land resources needed to produce this food, which is likely to be exacerbated by global warming (Lange and Nakamura, 2021).

The production and use of edible insects has arisen as one of the most fascinating alternative sources of proteins. Insect rearing has several advantages related to environmental sustainability comparing to cattle raising, namely insects emit less greenhouse gases, require less land and water and present high feed conversion efficiency. Insects are a highly nutritious source of food, with high protein, fat, vitamin, mineral and fiber content. The nutritional profile of edible insects depends on the species and can be highly variable (Borges et al. 2023; Lange and Nakamura, 2021).

Hermetia illucens, designated as black soldier fly (BSF), is attractive as a food/feed because is a non-infesting species contrary to *Musca domestica* (i.e common fly). BSF larvae (BSFL) are avid consumers of decomposing organic matter and able to convert efficiently huge amounts of waste or spoiled food into biomass. As for its chemical components, BSF prepupa is composed to 37 g/100 g lipids, 32 g/100 g proteins, 19 g/100 g mineral salts (including micronutrients, such as iron and zinc), and 9 g/100 g chitin (Montevecchi et al., 2021). BSFL are a well-recognized nutritious source with a high protein content. In this context, enzymatic hydrolysis can be a promising process for the development of new insect-based ingredients with improved bioactive properties. This approach is widely used as a way to obtain bioactive peptides from various food matrices such soy protein, milk protein, fish protein, egg white protein, among others.

Therefore, this work aimed to evaluate the potential of BSFL to generate bioactive peptides via enzymatic hydrolysis, with antioxidant and anti-hypertensive potential.

Methods



Results

Characterization of insect protein hydrolysates

Table 1 – Characterization of insect protein hydrolysates

	Degree of hydrolysis (%)	Protein (%)	Ashes (%)	Moisture (%)
Insect protein hydrolysate	59.1 ± 0.3	69.1 ± 0.3	8.7 ± 0.0	4.9 ± 0.2

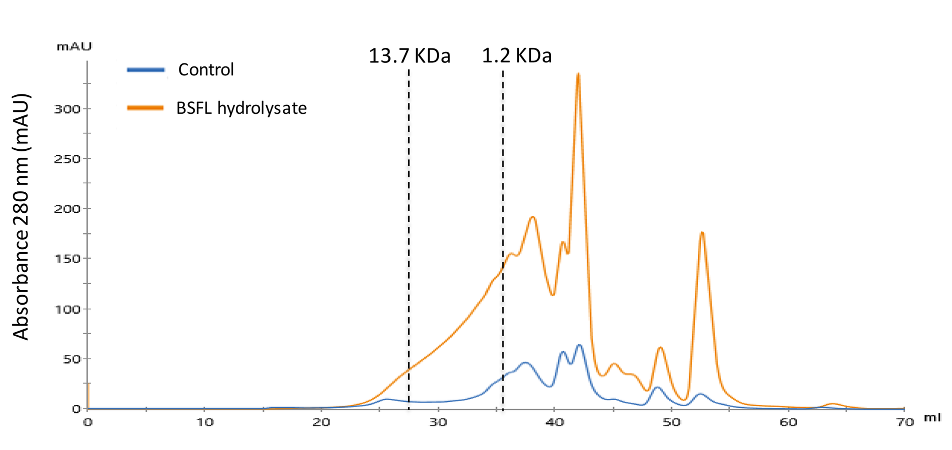


Figure 2 – Peptide profile of insect protein hydrolysates

Table 2 – Bioactivity of insect protein hydrolysates

Bioactivity	Antioxidant activity		Antihypertensive activity
	ABTS (µmol Trolox equivalent/ g dry extract)	ORAC (µmol Trolox equivalent/ g dry extract)	IC_{50} (µg of protein/mL)
Corolase	251.11 ± 10.08	567.34 ± 46.71	137.55
Control	35.02 ± 5.16	61.49 ± 3.91	-

Discussion/Conclusions

This work aimed to evaluate the potential of black soldier fly larvae to generate bioactive peptides via enzymatic hydrolysis. For this purpose, defatted BSFL meal was hydrolyzed with corolase at a ratio of 3.0% enzyme/substrate during 6 h (Sousa, Borges and Pintado, 2020), obtaining a degree of hydrolysis of ca. 59%. BSFL hydrolysates exhibited a protein content of approximately 70% (dry weight basis) with peptides of low molecular weight (below to 13.7 kDa). BSFL hydrolysates displayed antioxidant potential, i.e., 251.11 ± 10.08 µmol Trolox equivalent/g dry extract by ABTS method and 567.34 ± 46.71 µmol trolox equivalent/g dry extract by ORAC method. BSFL hydrolysates were also able to inhibit the angiotensin converting enzyme (ACE) with an IC_{50} of 137.55 µg of protein/mL, evidencing a remarkable antihypertensive activity.

Therefore, enzymatic hydrolysis showed that is a promising technology to generate BSFL hydrolysates with beneficial activities (antioxidant and antihypertensive) that have potential to reinforce cardiac function. In light of these evidences, BSFL hydrolysates can be used as an alternative, functional and sustainable ingredient for food/feed applications.

References

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