# Potentiality of protein hydrolysates from *Tenebrio molitor* for health and nutrition

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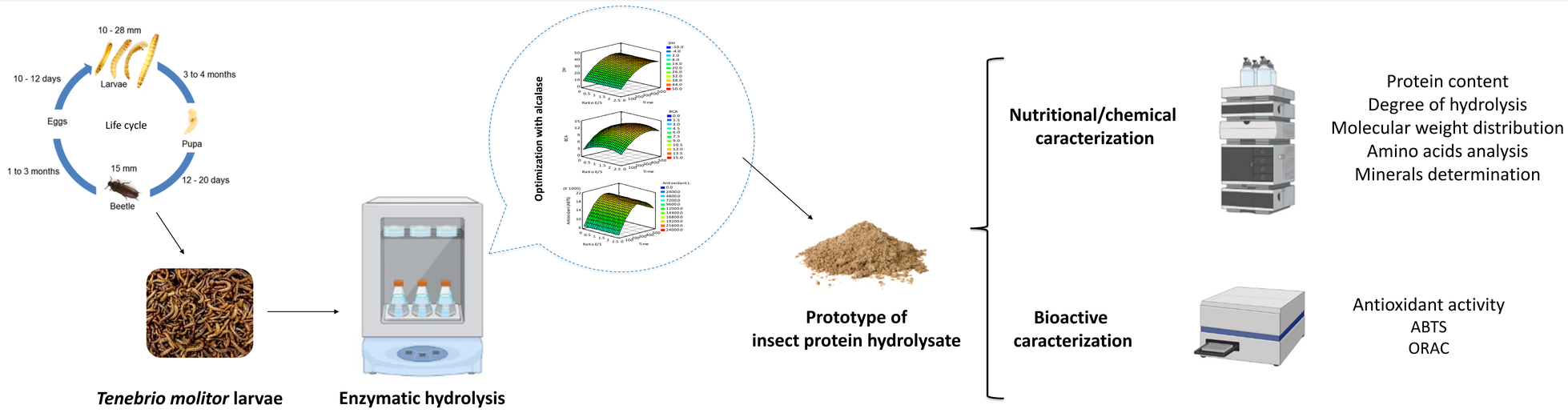
## Introduction

The world's population counts more than 7.8 billion people, and it is predicted that by the year 2050, this number will be close to 10 billion. Increasing agricultural and animal production will obviously have an influence on population growth and food demand, which will increase deforestation, water usage, and greenhouse gas emissions. This scenario emphasizes the importance of adopting a more sustainable and balanced food source that prioritizes food safety, biodiversity and an efficient distribution of high-quality proteins for the entire world's population. Emergent and sustainable food sources comprise vegetables, microorganisms and insects (Barbosa *et al.* 2023).

In recent years, edible insects have gain popularity due to their nutritional value, as they are a great source of dietary protein (approximately 60%), essential amino acids, fat and minerals. In countries where malnutrition is common, insects may offer a potential solution for mineral deficiencies (such as zinc and iron). Several peptides and amino acid sequences have been identified within a wide range of dietary proteins, which have been associated with bioactive properties. These have been identified, for example, for their antihypertensive, antioxidant, antidiabetic, immunomodulatory and mineral-binding properties (Nongonierma and FitzGerald 2017, Sousa *et al.* 2020). In addition, insects are environmentally sustainable due to the lower greenhouse gas emissions, less soil and water consumption, and have higher feed conversion efficiency than traditional livestock (Borges *et al*. 2023).

In this study, *Tenebrio molitor* protein were broken down enzymatically into bioactive peptides and individual amino acids, in order to provide a promising source of nutritional and health compounds.

## Methods




## Results

**_Tenebrio molitor_ hydrolysate caracterization**

Hydrolysis degree 37.9 ±2.0%

Protein content 68.1 ± 0.3%

Ash 6.6 ± 0.0%

Moisture 5.1 ±0.0

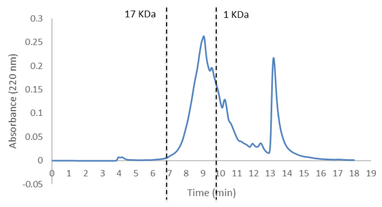



Figure 1 - Molecular weight distribution of insect protein hydrolysate

Table 1 – Total amino acids of insect protein hydrolysate

| Amino acids (mg/g) | |
|---|---|
| Aspartic acid | 5.31 ± 0.29 |
| Glutamic acid | 9.28 ± 0.30 |
| Cysteine | 0.43 ± 0.01 |
| Serine | 1.92 ± 0.09 |
| Histidine | 3.78 ± 0.07 |
| Glycine | 3.41 ± 0.05 |
| Threonine | 2.95 ± 0.11 |
| Arginine | 0.58 ± 0.01 |
| Alanine | 6.34 ± 0.18 |
| Tyrosine | 2.71 ± 0.09 |
| Valine | 4.25 ± 0.25 |
| Methionine | 0.12 ± 0.03 |
| Phenylalanine | 0.96 ± 0.05 |
| Isoleucine | 2.45 ± 0.09 |
| Leucine | 4.45 ± 0.13 |
| Lysine | 2.73 ± 0.04 |
| Tryptophan | n.d. |
| Taurine | n.d. |

n.d. - not detected

Table 2 – Minerals of insect protein hydrolysate

| Minerals (mg/g) | |
|---|---|
| Calcium | 0.58 ± 0.00 |
| Iron | 0.04 ± 0.00 |
| Potassium | 20.30 ± 0.21 |
| Magnesium | 4.26 ± 0.02 |
| Sodium | 3.64 ± 0.03 |
| Phosphorus | 10.75 ± 0.02 |
| Zinc | 0.059 ± 0.001 |
| Copper | 0.012 ± 0.000 |
| Aluminium | n.d. |

n.d. - not detected

Table 3 – Antioxidant activity of insect protein hydrolysate

| Antioxidant activity | |
|---|---|
| ABTS (µmol Trolox/g hydrolysate) | ORAC (µmol Trolox/g hydrolysate) |
| 392.91 ± 20.34 | 740.58 ± 26.92 |

## Discussion/Conclusions

The aim of this study was to produce and validate the potential of *Tenebrio molitor* insect as a healthy and nutritive ingredient. *Tenebrio molitor* larvae were enzymatically hydrolyzed using an endopeptidase. The insect protein hydrolysate exhibited:

- High protein content with peptides lesser than 17 kDa;
- All essential amino acids. The most abundant amino acid was glutamic acid (9.28 ± 0.30 mg/g);
- Essential minerals namely high levels of potassium, whose deficiency is associated with hypertension and increased risk of cardiovascular disease;
- A notable antioxidant capacity, by ABTS and ORAC methods. Antioxidant peptides can play an effective role to reduce excessive radicals in the body and, consequently, prevent and treat cardiovascular diseases.

These results suggest that enzymatic hydrolysis can be used for the conversion of *Tenebrio molitor* protein into bioactive peptides providing a potential source of nutritional compounds for the prevention of cardiovascular diseases. Insect-based food should rely on further investigation, allowing innovative and sustainable solutions to be placed on clearer grounds.

## References

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