KU LEUVEN GENT

The 75th EAAP Annual Meeting

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Stellenbosch UNIVERSITY IYUNIVESITHI UNIVERSITEIT

The effect of different wet fractionation methods on the yield of *Hermetia illucens* larval fractions and the distribution of the main constituents

SU Promotor – Elsje Pieterse

KU Leuven Promotor – Ilse Fraeye

Presentation structure

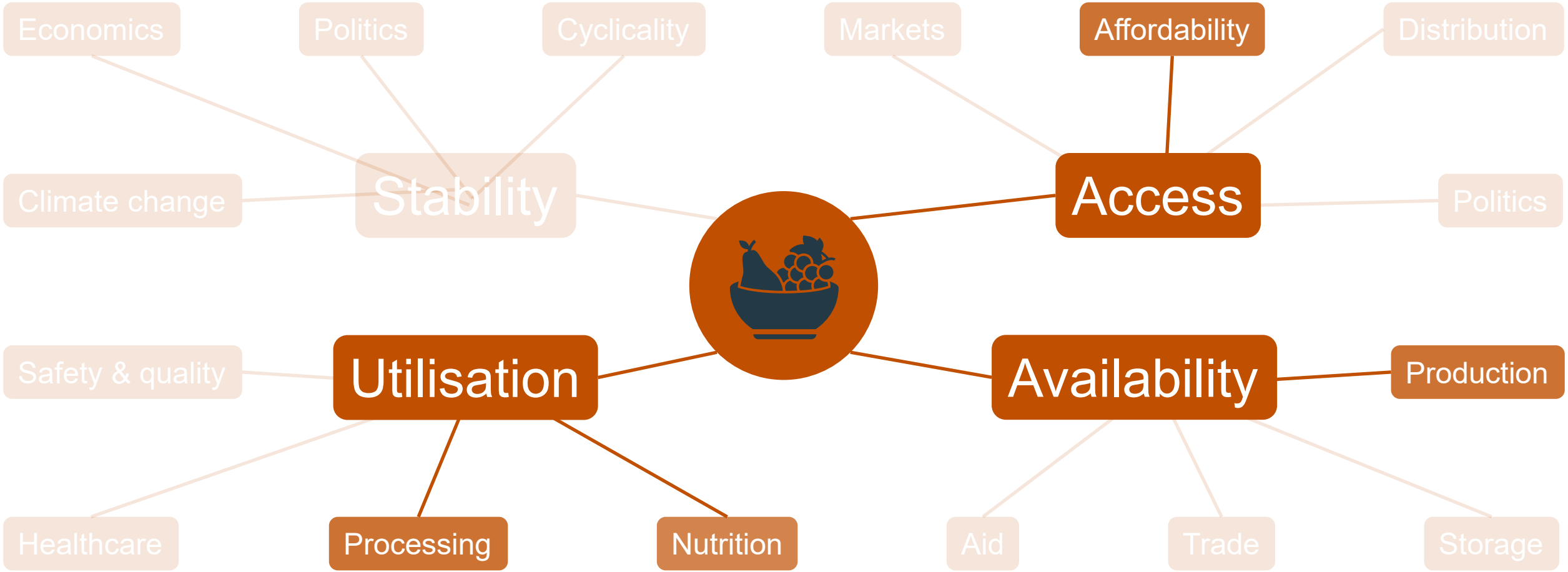
Introduction

Materials & Methods

Results & Discussion

Conclusion

Introduction
Food Security



Introduction
Insects in Human nutrition

Insects consumed for thousands of years

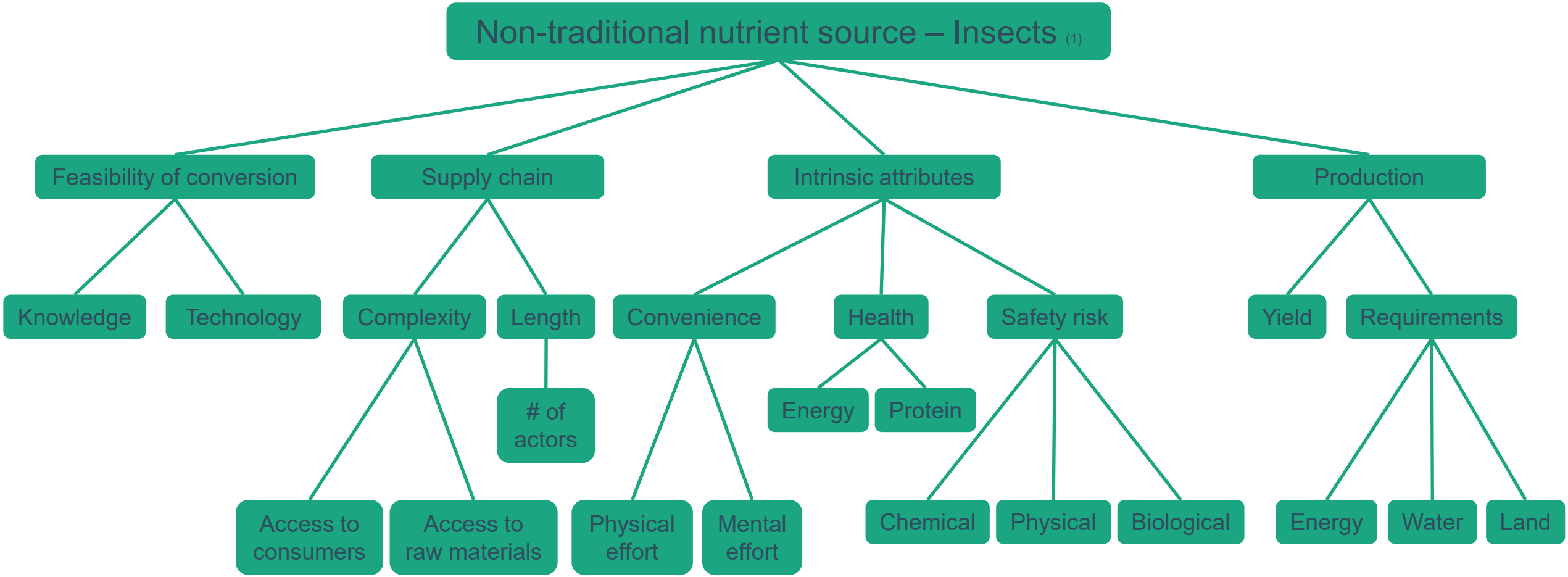
Not traditionally part of Eurocentric diets

Novel addition/alternative to protein and energy sources

Rich source of proteins and fats

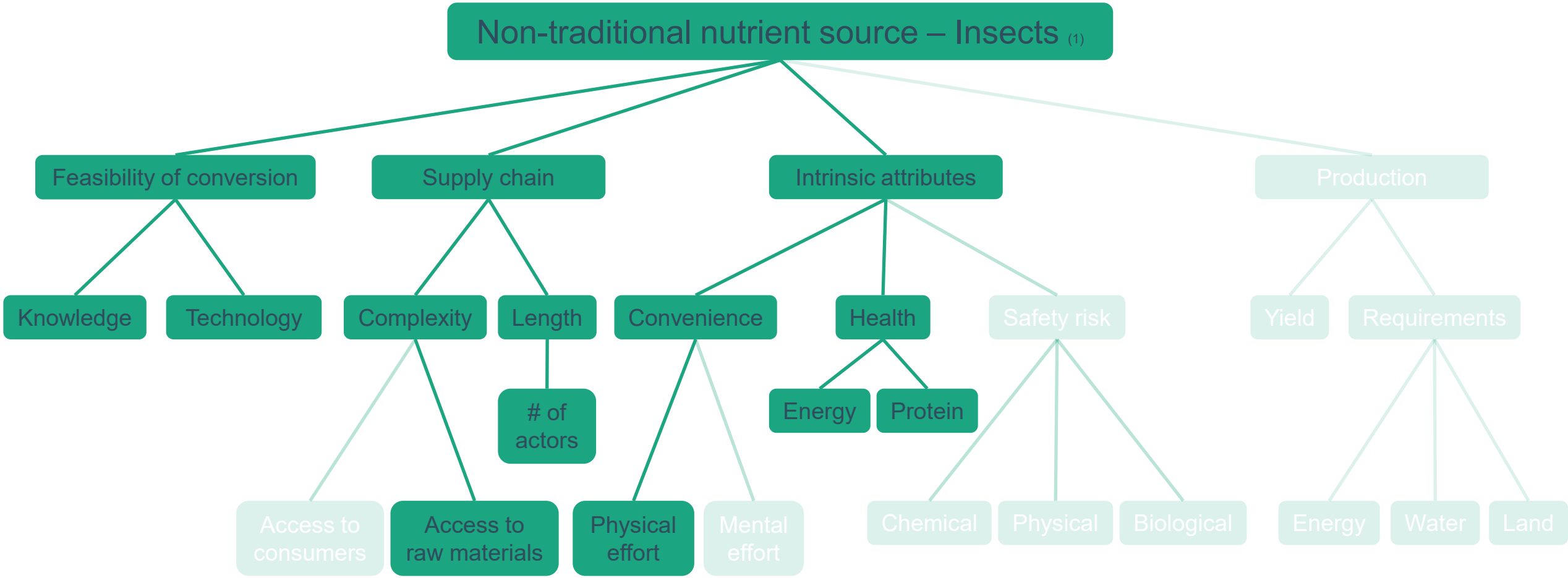
(2) Image reference: https://www.thailandunique.com/blog/what-will-take-western-countries-eating-insects/

Introduction
Fundamental changes in food systems



(1) (Boccardo *et al.*, 2023)

Introduction
Edible insect production



(1) (Boccardo *et al.*, 2023)

Introduction

Hermetia illucens knowledge gaps and potential

Sector	Research focus	Field
H. illucens production	Larval rearing and nutrition	Production animal science
Larval processing	Processing efficiency and product yield	Waste management Process engineering
Larval component application	Application of a single component	Food technology Engineering

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Hermetia illucens knowledge gaps and potential

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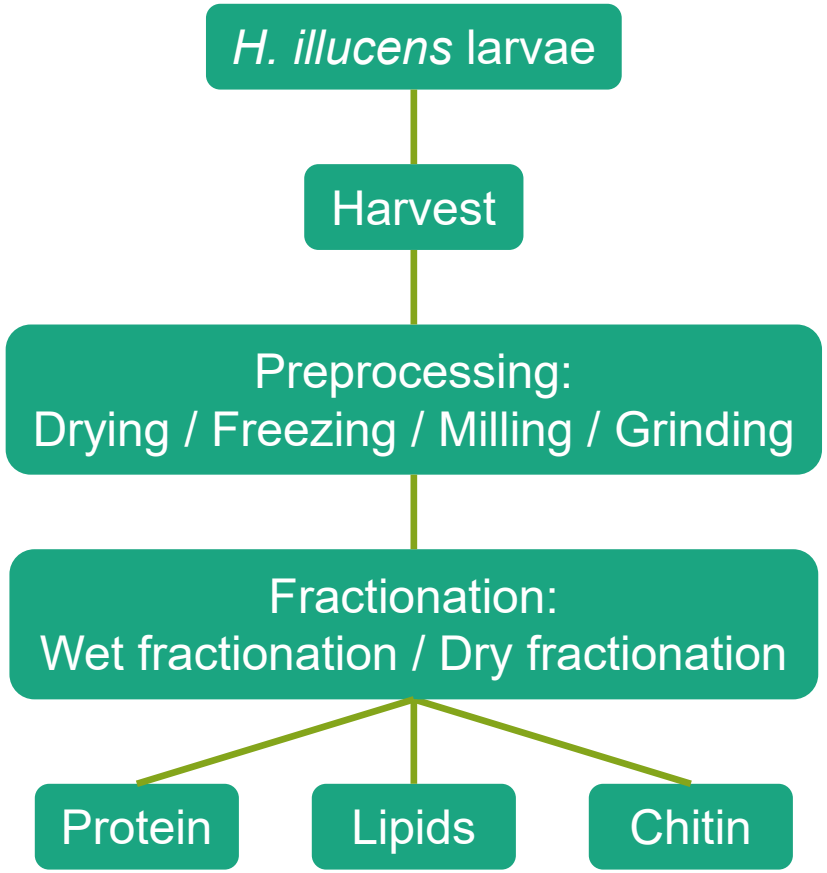
Larval processing - Fractionation



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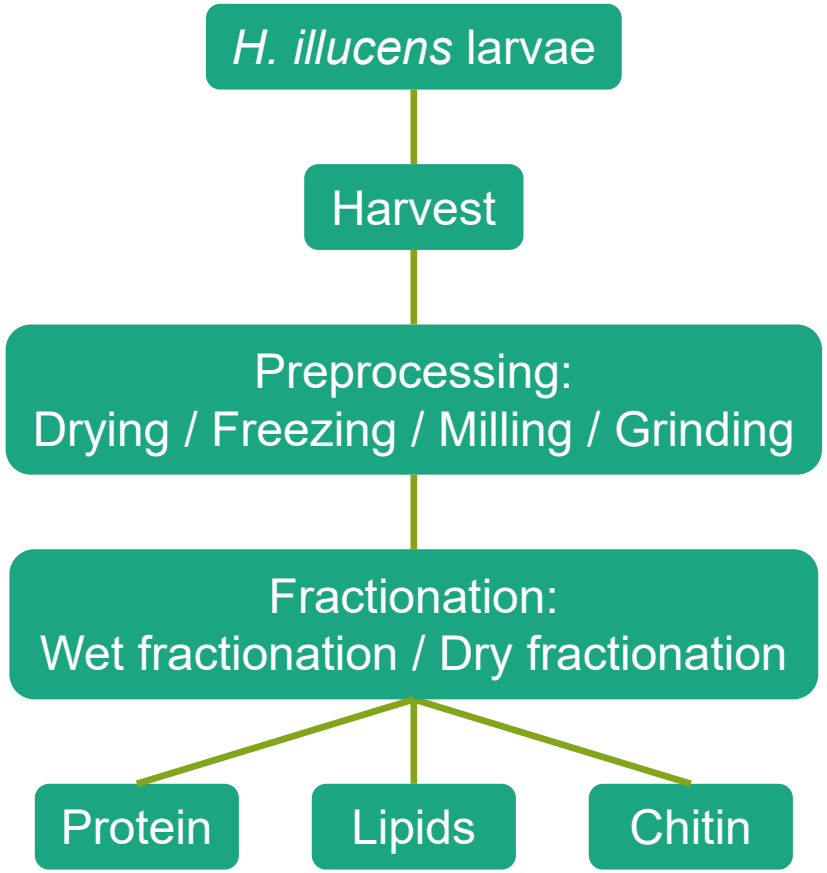
Larval processing - Fractionation



Three main larval components (protein, lipids, chitin) (2)

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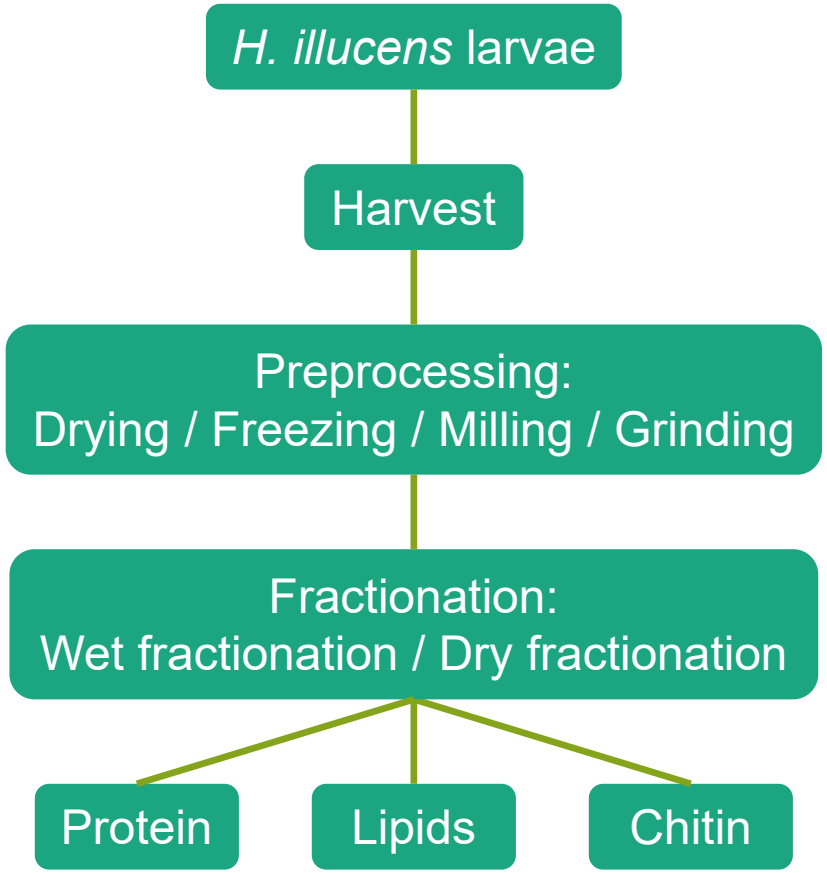
Larval processing - Fractionation



Three main larval components (protein, lipids, chitin) (2)

Component ratio influenced nutrition and environment (3)

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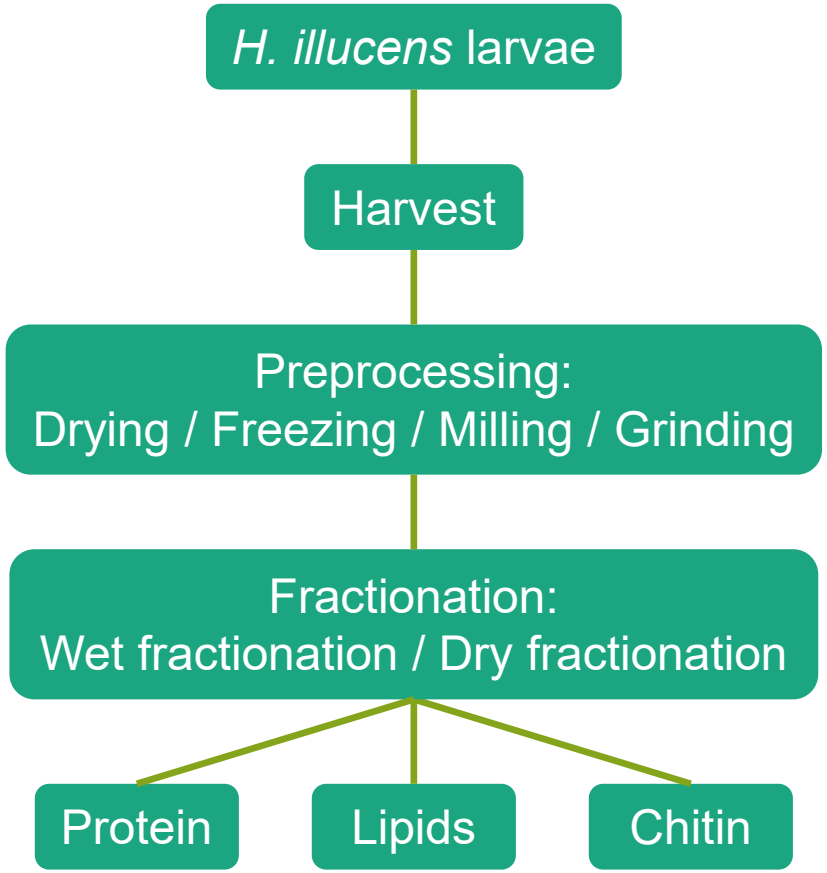
Larval processing - Fractionation



Three main larval components (protein, lipids, chitin) (2)

Lipid content limits larval inclusion in animal feed (4)

Component ratio influenced nutrition and environment (3)

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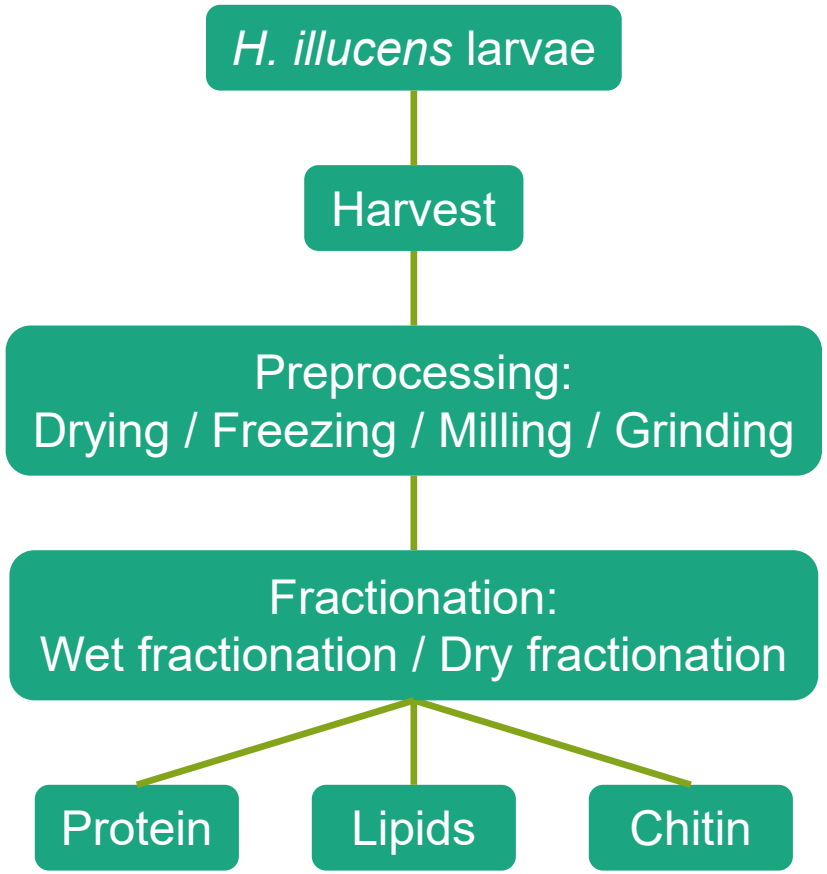

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Fractionation separates components, increases applications (5)

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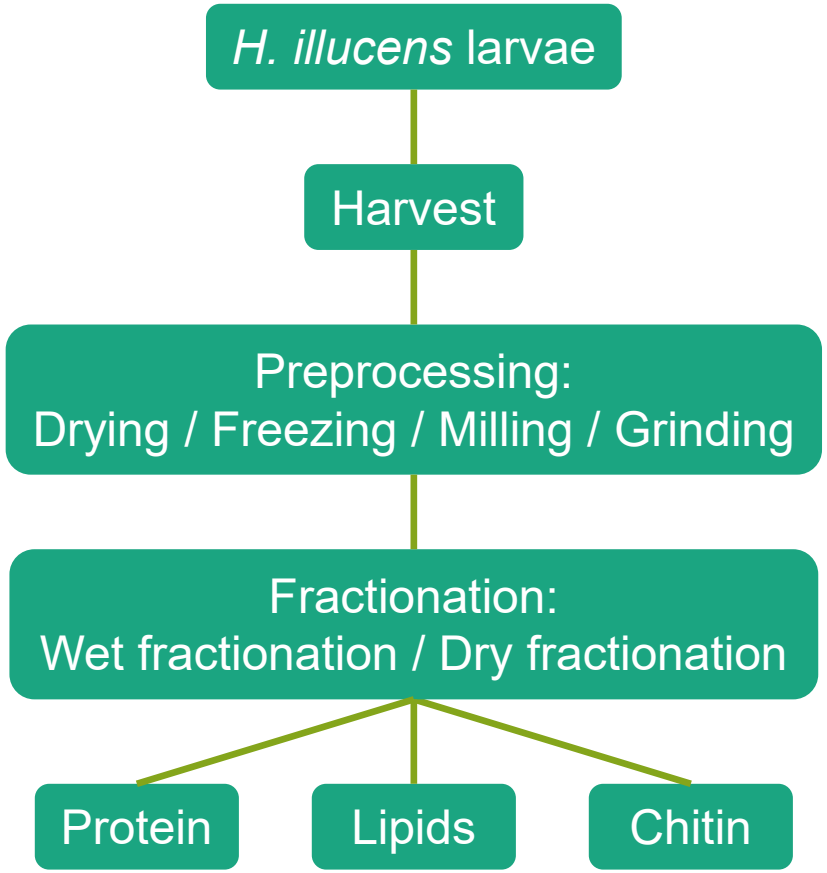
Larval processing - Fractionation



Three main larval components (protein, lipids, chitin) (2)

Fractionation requires resources (chemicals, equipment) (6)

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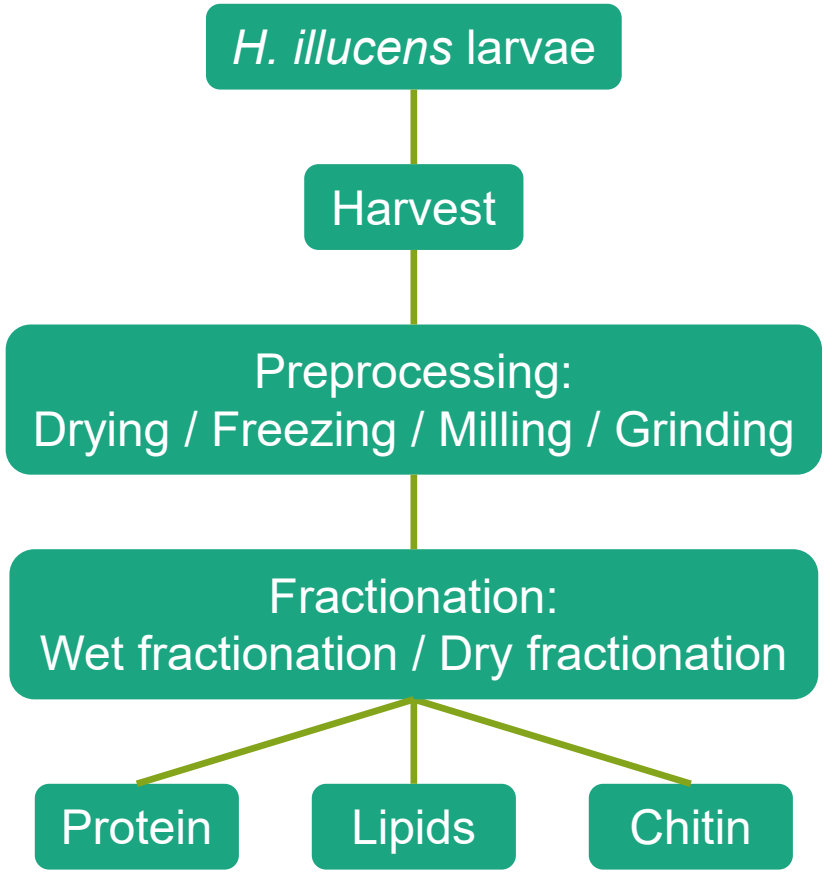

Three main larval components (protein, lipids, chitin) (2)

Process effects component characteristics (7)

Fractionation separates components, increases applications (5)

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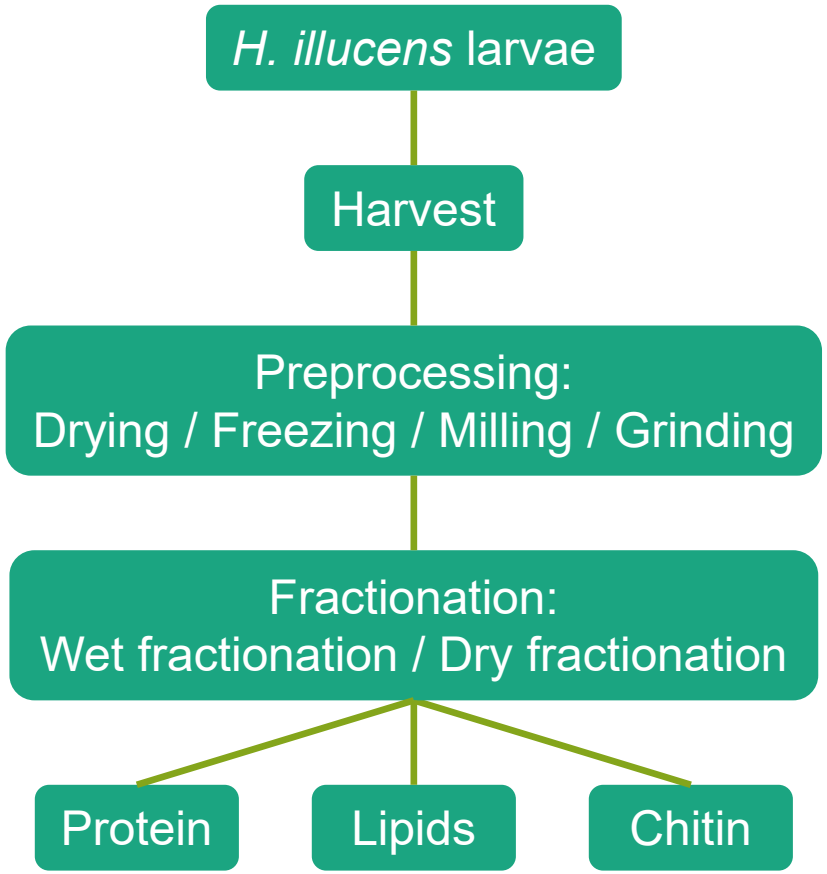
Larval processing - Fractionation



Three main larval components (protein, lipids, chitin) (2)

Are there low-tech fractionation methods that can be used?

Fractionation separates components, increases applications (5)

Component ratio influenced nutrition and environment (3)

Fractionation requires resources (chemicals, equipment) (6)

Lipid content limits larval inclusion in animal feed (4)

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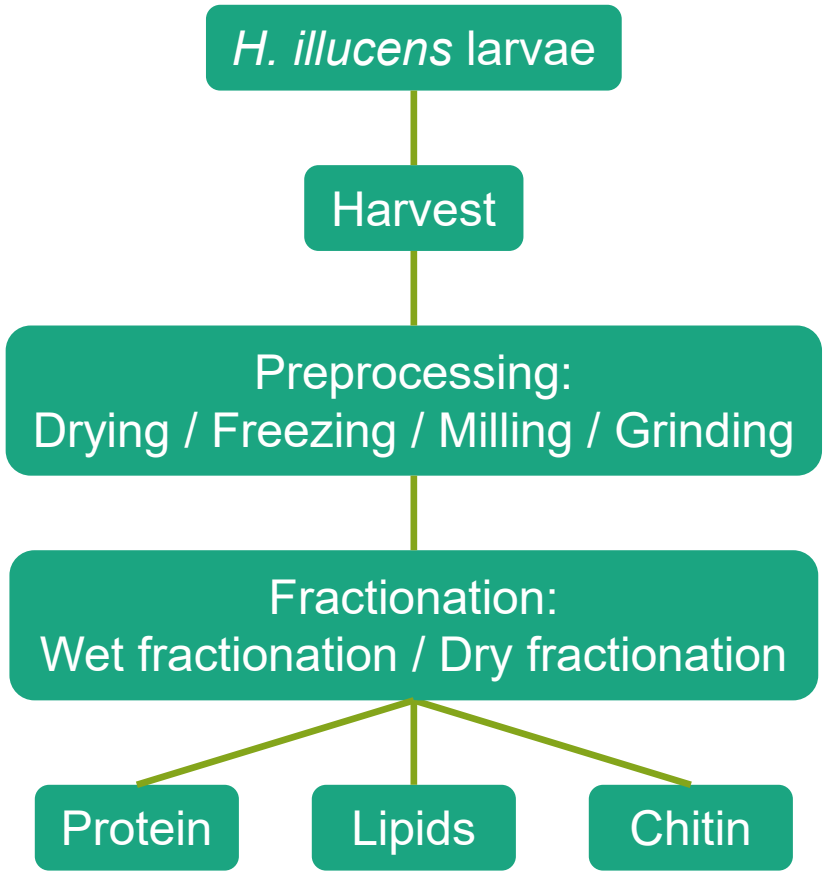
Introduction
Larval processing - Fractionation



Three main larval components (protein, lipids, chitin) (2)

How does the fractionation method influence fraction composition?

Fractionation separates components, increases applications (5)

Component ratio influenced nutrition and environment (3)

Are there low-tech fractionation methods that can be used?

Fractionation requires resources (chemicals, equipment) (6)

Lipid content limits larval inclusion in animal feed (4)

Process effects component characteristics (6)

(2)(Ravi *et al.*, 2020) (3)(Danieli *et al.*, 2019)
(4)(Barragan-Fonseca *et al.*, 2017) (5)(Ravi *et al.*, 2021)
(6)(Caligiani *et al.*, 2018) (7)(Soetemans *et al.*, 2019)

Introduction
Larval processing - Fractionation

Are there low-tech fractionation methods that can be used?

How does the fractionation method influence fraction composition?

H. illucens larval fractionation

How do different low-tech fractionation methods compare in terms of their effect on *H. illucens* larval fraction yield and composition?

Materials & Methods

H. illucens larval fractionation

How do different low-tech fractionation methods compare in terms of their effect on *H. illucens* larval fraction yield and composition?

Insects

12 day old *H. illucens* larvae that were reared on the formulated diet blanched and frozen at until needed.

Blanched and frozen at -20°C

Materials & Methods

H. illucens larval fractionation

Insects

Pre-processing

Thawed overnight at 4°C

Rinsed with cold water

Patted dry with paper towel

Manually minced

Materials & Methods

H. illucens larval fractionation

Insects | Pre-processing

Fractionation treatments

Acidic treatments

- Control solution (Con pH2)
- Acetic acid solution (AA)
- Formic acid solution (FA)
- Lactic acid solution (LA)

- Control - Distilled H_2O, pH adjusted with 6M HCl
- Treatments - Distilled H_2O, pH2 adjusted with organic acid
- Organic acids chosen based on literature and availability in South African setting (7)

(7)(Soetemans *et al.*, 2019)
(8)(Cadesky, 2017)
(9)(Azzollini *et al.*, 2020)

Materials & Methods

H. illucens larval fractionation

Insects | Pre-processing | Fractionation treatments

- Con pH2
- AA
- FA
- LA

Alkaline treatments

- Control solution (Con pH12)
- Control with enzyme (Con+Enz)
- Solution A with enzyme (A+Enz)
- Solution B with enzyme (B+Enz)

Control - Distilled H_2O, pH12 adjusted with 6M NaOH

Treatments – Combination of solution and enzyme

Enzyme – Commercially available protease (9)

Solutions based on a patent for insect derived products

Solution A (8)
- Distilled H_2O
- Ascorbic acid
- Citric acid
- Sodium chloride
- Calcium chloride
- 6M NaOH

Solution B (8)
- Distilled H_2O
- Ascorbic acid
- Citric acid
- 6M NaOH

(7)(Soetemans *et al.*, 2019)
(8)(Cadesky, 2017)
(9)(Azzollini *et al.*, 2020)

Materials & Methods

H. illucens larval fractionation

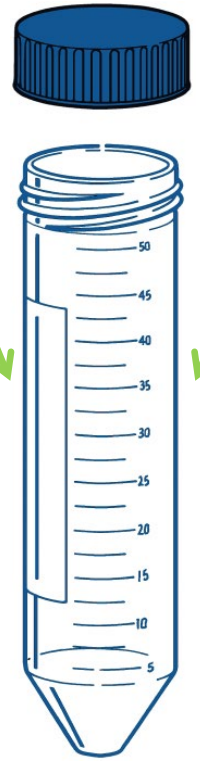
Insects | Pre-processing | Fractionation treatments

Administering treatments

15ml treatment solution

Eight treatments

Three replicates per treatment



15g minced larvae biomass

Con pH2	Con pH12
AA	Con+Enz
FA	A+Enz
LA	B+Enz

Materials & Methods

H. illucens larval fractionation

Insects | Pre-processing | Fractionation treatments | Administering treatments

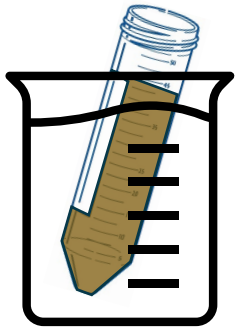
Incubation

Con pH2	Con pH12
AA	Con+Enz
FA	A+Enz
LA	B+Enz

Mixture vortexed for distribution

Incubation at room temperature for 30 min

Enzyme deactivation (90°C water bath, 5 min)

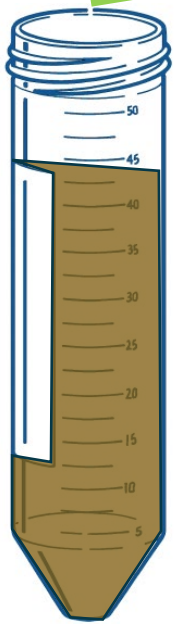


Materials & Methods

H. illucens larval fractionation

Insects | Pre-processing | Fractionation treatments | Administering treatments | Incubation

Mechanical separation → Chitin-rich fraction



Larval mixture hand pressed through sieve → Aqueous mixture collected → Press rinsed with 15ml treatment solution → Aqueous mixture collected

Chitin-rich fraction collected → Weighed → Oven dried → Chemical analysis

Con pH2	Con pH12
AA	Con+Enz
FA	A+Enz
LA	B+Enz

(24)https://www.starlabgroup.com/GB-en/product/50-ml-centrifuge-tube-conical-loose-sterile-e1450-0200.html

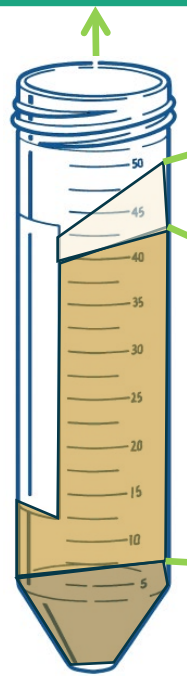
Materials & Methods

H. illucens larval fractionation

Insects | Pre-processing | Fractionation treatments | Administering treatments | Incubation

Mechanical separation | Chitin-rich fraction

Aqueous mixture separation



Aqueous mixture

- Lipid-rich top fraction
- Protein-rich aqueous fraction
- Protein-rich pellet fraction

Centrifuged → Individual fractions removal → Weighed → Oven dried → Chemical analysis

Con pH2	Con pH12
AA	Con+Enz
FA	A+Enz
LA	B+Enz

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Picture:https://www.starlabgroup.com/GB-en/product/50-ml-centrifuge-tube-conical-loose-sterile-e1450-0200.html

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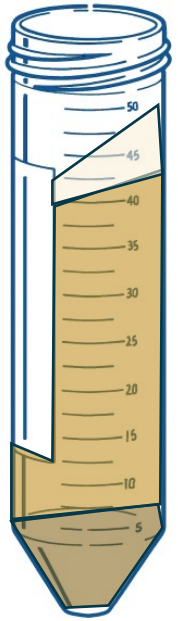
Materials & Methods

H. illucens larval fractionation

Insects | Pre-processing | Fractionation treatments | Administering treatments | Incubation

Mechanical separation | Chitin-rich fraction | Aqueous mixture separation

Treatments		Fractions
Con pH2	Con pH12	Chitin-rich fraction collected
AA	Con+Enz	Lipid-rich top fraction
FA	A+Enz	Protein-rich aqueous fraction
LA	B+Enz	Protein-rich pellet fraction



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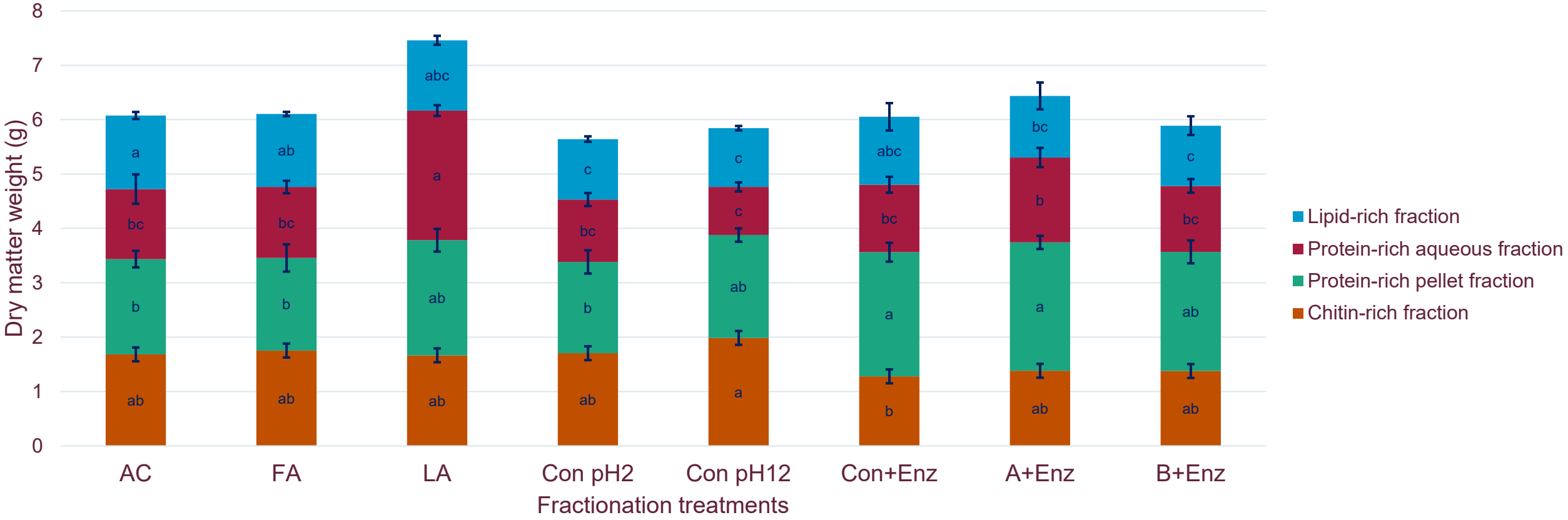
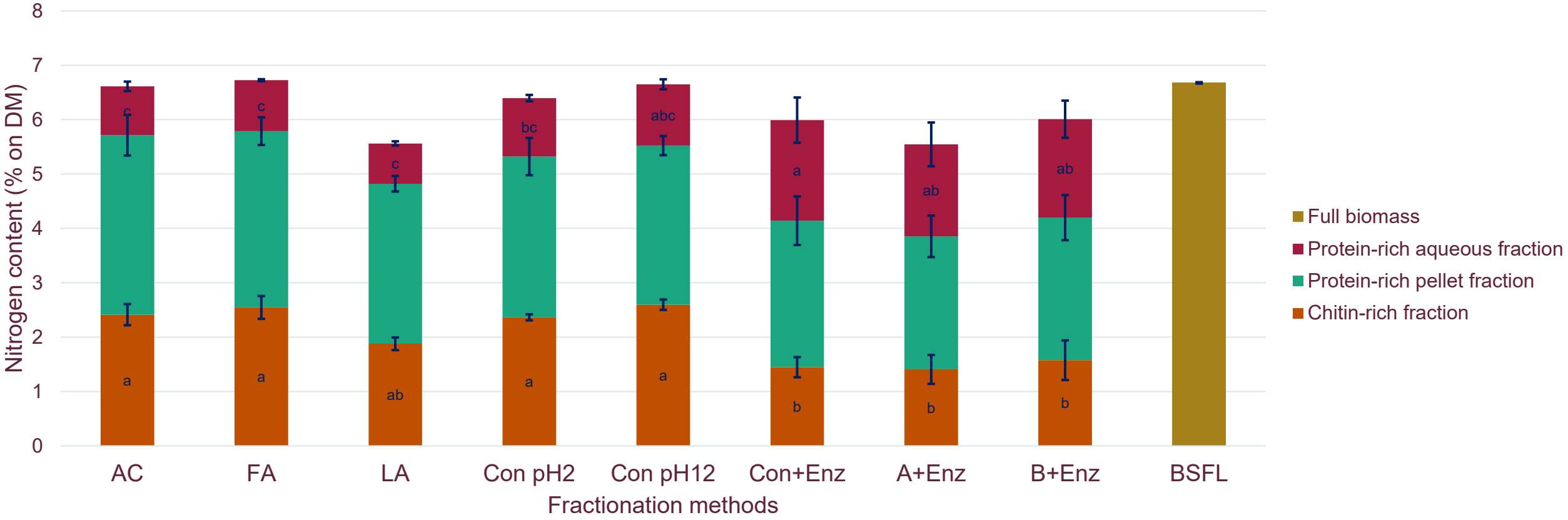
Results & Discussion
Fraction yield

Dry matter weight of *H. illucens* larval fractions resulting from biomass being subjected to different wet fractionation methods



Results & Discussion
Fraction yield

Nitrogen content distribution among *H. illucens* larval fractions resulting from biomass being subjected to different wet fractionation methods



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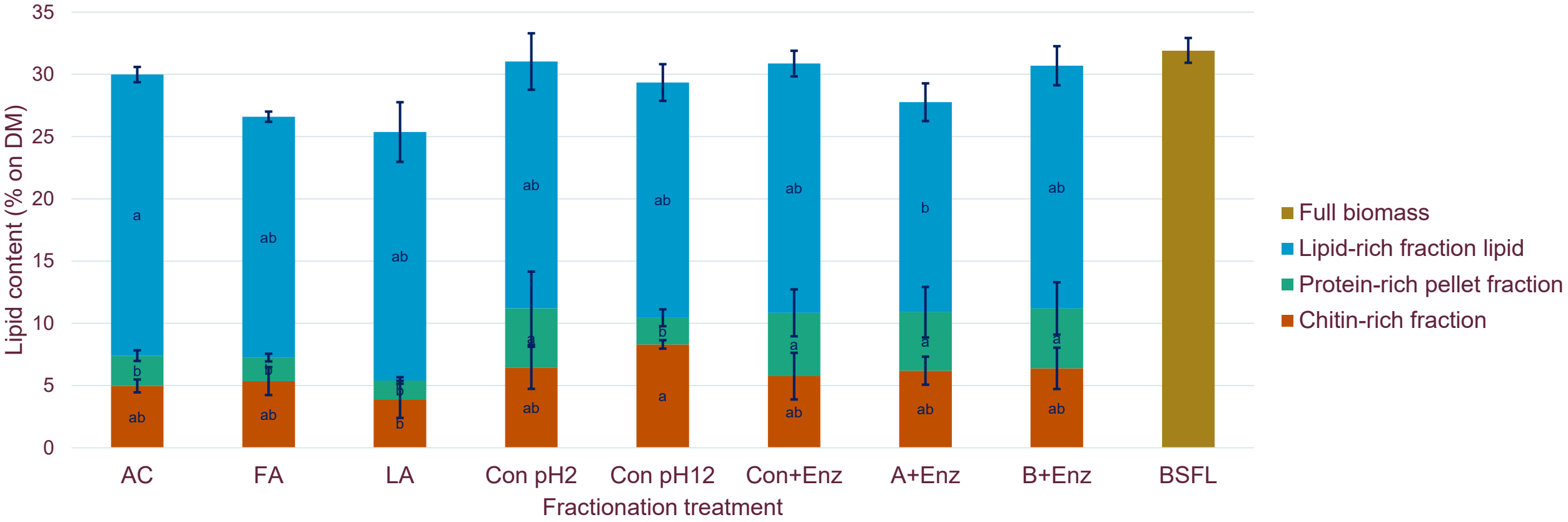
Results & Discussion
Fraction yield

Lipid content distribution among *H. illucens* larval fractions resulting from biomass being subjected to different wet fractionation methods



Conclusion & Moving forward

Dry matter yield was affected by process	→ Selection and optimisation of low-tech wet fractionation process
Fraction composition was affected by process	→ Composition analysis of constituents (lipid profile and protein profile)
Nitrogen and lipid distribution was affected	→ Determination of the changes in functionality of constituents of interest

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Thank You

Comments Questions

Belgium partner in development

vliruos SHARING MINDS, CHANGING LIVES

NRF National Research Foundation

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