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LEADING A REVOLUTION IN BIOWASTE RECYCLING

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Subtask 5.3.1: Applications of insect proteins in food and feed industry

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  - Protein extraction,
  - Amino acid profile,
  - Techno-functionalities of BSFL proteins
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  - Meat analogues
  - Dog food
  - Salmon feed
- Conclusions

Objectives Subtask 5.3.1.

- Obtain extraction procedure to obtain high protein and functional fractions of BSFP.
- Assess the nutritional value of BSFP based on its amino acid profile (AAP).
- Test the applicability of BSFP in:
  - Meat Analagues (UF),
  - Dog food (BSFL),
  - Fish feed (BSFL).

Extraction, Amino Acid profile and Functionality of BSFP

- Protein Extraction: purifying BSF protein by extraction methods (Ultrafiltration - UF & Isoelectric precipation - IP). UF protein content is higher (96.4%) than for IP (76.0%), conversely extraction yield is lower (24.3) for UF compared to 37.2% for IP.

- Amino Acid (AA) profile: analysis and comparison of BSFP AA-profile to other insect AA-profile, pulses and casein. Essential Amino Acid Index of BSF protein is high (1.72) compared to other insect proteins, beans and peas and above FAO/WHO/UNU minimum of 27.7 g/100 g for human requirement. Only certain soy products and casein have a higher EAAI.

- Functionality: foaming, oil and water holding capacity. UF-BSFP selected for meat analogue testing due to higher oil binding capacity compared to IP-BSFP

- Results are submitted for publication:

Extraction, nutritional and functional properties of proteins from black soldier fly larvae reared of canteen waste

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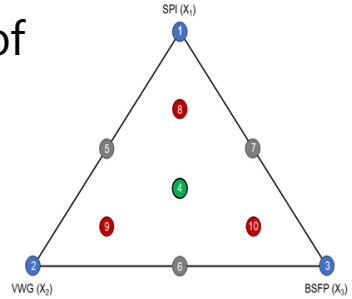
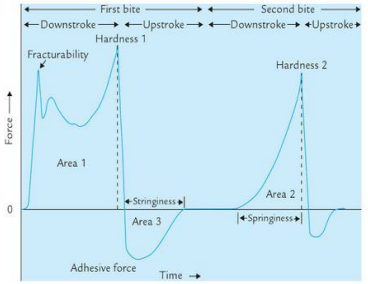
Application: incorporation of BSFL Proteins in MEAT ANALOGUES

Incorporation of BSFL proteins in meat analogues.

- Laboratory extrusion of Meat Analogue formulations consisting of Vital Wheat Gluten, Soy Protein Isolate and UF-BSFP (0-40%) in a mixture design. (Other components: 55% water and 5% oil)



- Evaluation of Meat Analogues by Texture Profile Analysis. Comparison is made to chicken breast.

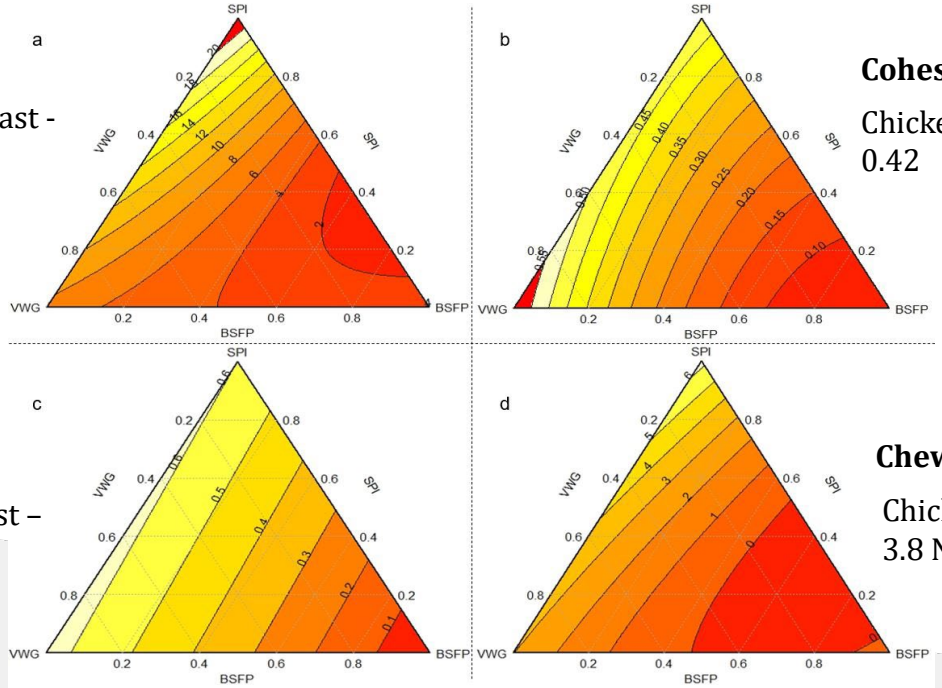


Incorporation of BSFL in meat analogues

- 6.7% BSFL proteins can be incorporated in meat analogues formulation to closely mimic the texture of chicken breast.

Hardness

Chicken breast - 17.2 N



Cohesiveness

Chicken breast – 0.42

Springiness

Chicken breast – 0.52

Chewiness

Chicken breast– 3.8 N

Miron *et al.*, 2022. Manuscript submitted

- **Application: incorporation of BSFL meal in DOG FOOD**

Incorporation of BSFL in dog food

- Two dog food formulations: conventional *vs.* BSFP at 13% inclusion. BSFP inclusion at the expense of poultry-, bone- and greaves-meal and rape seed oil.

- Dog food is produced by extrusion (twin-screw extruder) at two different temperature profiles (130°C and 150°C).

- Assessment of kibbles by Texture Profile Analysis and Durability testing.

Incorporation of BSFL in dog food

- Dog food kibbles

Conventional (130 ℃) | With insects (130 ℃) | Conventional (150 ℃) | With insects (150 ℃)

- No relevant differences between conventional diet *vs.* diet with insects in Texture Profile Analysis traits. Therefore, suitable for use in dog food.
- Durability of formulation at lower extrusion temperature profile (130°C) with insect protein is higher than conventional formulation durability.

Application: incorporation of BSFL meal in SALMON FEED

Incorporation of BSFL in salmon feed

❑ Salmon feed formulation & results

Raw material	Composition without insect (%)	Composition with insect (%)
Fish meal	52	46
Wheat gluten	5.67	5.67
Soybean meal	26.7	26.7
Wheat	12.6	12.6
Sunflower meal	2.65	2.65
Premix	0.38	0.38
BSFL meal		6

Quality parameter	Composition without insect	Composition with insect
Hardness (N)	16.7	**22.9**
Durability (%)	84.2	**88.0**
Bulk density (g/cm^3)	0.50	0.48
Expansion ratio (%)	**32.11**	6.33
Sinking velocity (cm/s)	**0.25**	0.11
Oil absorption capacity (%)	53.6	**58.3**
Oil leakage (%)	**9.6**	8.3

- Hardness, durability and oil absorption where higher compared to the standard composition.
- Expansion ratio, sinking velocity and oil leakage where lower for BSFP-extruded fish feed compared to the standard composition. Additional tweaking is required.

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Overall Conclusions

- The applicability of ultrafiltration/isoelectric precipitation for extraction of functional proteins from BSFL has been demonstrated.

- The sum of essential amino acids (48.06 g/100 g) of BSFL protein is higher than the recommendation of FAO/WHO/UNU (minimum 27.7 g/100 g) to meet human requirements, and high amongst insect proteins.

- 6.7% UF-BSFP can be incorporated in meat analogue formulations in combination with SPI and VWG to closely mimic the texture of chicken breast.

Overall Conclusions

- BSFL yields equal texture parameters for dog food kibbles compared to the control and has a positive influence on the durability of dog food kibbles when processed at 130 °C.

- Differences are observed in various physical pellet quality traits for salmon feed.
  - Hardness, durability and oil absorption where higher compared to the standard composition.
  - Expansion ratio, sinking velocity and oil leakage where lower for BSFP-extruded fish feed compared to the standard composition.

- BSFL can replace conventional sources of proteins and oils in dog food and salmon feed.

THANK YOU!

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