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Invaluable WP7

Product development and sensory

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Agenda

- What is DTI and who am I?
- Insect flavor wheels
- Different possible product applications
- Overcoming the reduced raising abilities in whole meal bread, where whey flour is substituted with insect flour

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About DTI Food Technology

Product development
New food concepts, applications, novel technologies

Physical and chemical characterisation
Characterisation & analysis

Process development
Microencapsulation, drying and stabilisation of ingredients

Food safety
Legislation and labelling
HACCP, prevention of food fraud

Sensory & consumer tests
Consumer and market tests
Sensory of food and non-food

Pilot production
Extrusion of food and feed, milling,

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How DTI Food Technology can help your business

- Product development of insect food products
- Functionality of insect ingredients
  - Emulsion capacity, water-absorption, foam-stabilising ability
- Insect meal processing
  - Lipid extraction (pilot scale)
  - Protein extraction (pilot scale)
  - Extrusion (pilot scale)

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About me

- Simon Hvid
- Consultant at DTI – center for Food Technology
- Chemisty and biochemistry engineer – Cand.Polyt
- Working with insects as food ingredient for 3 years

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Flavor wheel of insect flour

- A panel of 12 assesors are chosen from a panel of 40 judges
- Performed a sensory analysis following the ISO 13299-2016
- Tested insect flour: Freeze dried and grinded with 1 mm pore size
  - Buffalo larvae flour (*Alphitobius diaperinus)*
  - House Cricket (*Acheta domesticus)*
  - Mealworm (*Tenebrio Molitor)*

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Collaboration with Erhvervsakademi Midtvest

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Flavor wheel of insect flour

- Several steps
  - Identifying descriptions of tase (79 in total)
    - Keywords: Protein / meat flavor, ”floury” mouthfeel as malt, mash, hay, harshness
  - Reduce words
    - V is removed as it was measured by equipment
    - Umami and Bitter as aftertaste removed as they are also taste
    - Fatty mouthfeel removed from test

Visual Appearance (V)	Taste (T)	Smell (S)	Mouthfeel (M)	Aftertaste (A)
Redbrown / greenbrown	Roasted ryebread	Zoo	Crunchy	Umami
Dry / moist	Collagen		Fatty	Bitter
	Bitter (former dark chocolate)			Metallic
	Old (former harsh)			
	Sweet			
	Umami			
	Fish feed			

Collaboration with Erhvervsakademi Midtvest

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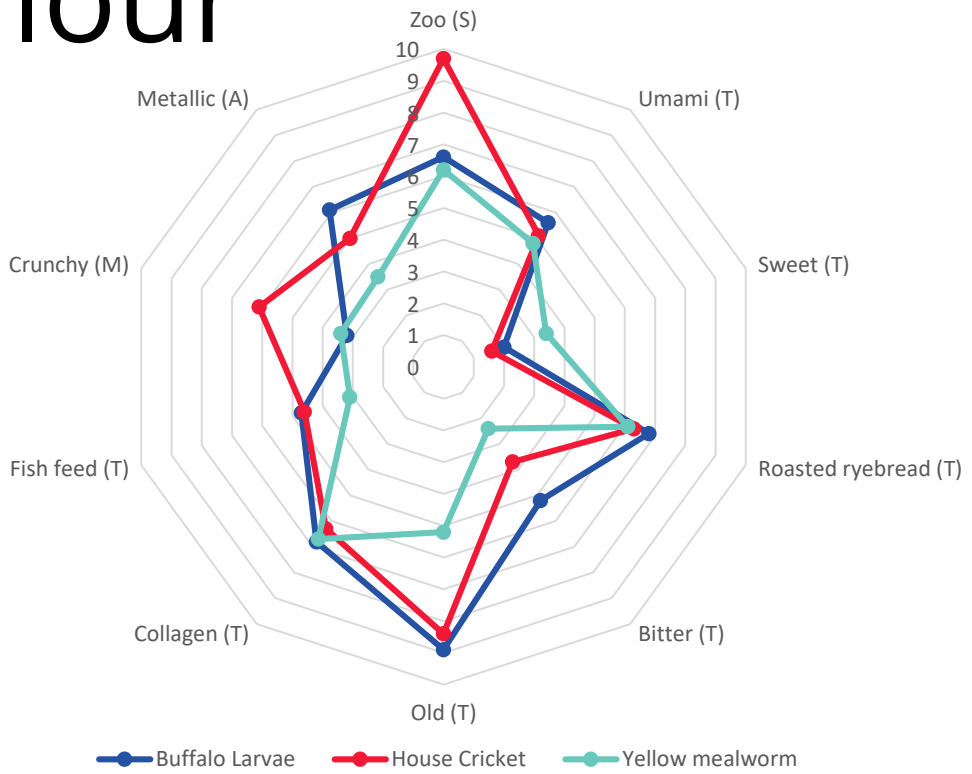
Flaver wheel of insect flour

- House cricket differ from both mealworms, especially in ”Zoo” smell and being crunchy
- The yellow mealworm tends to be more mild
- Crossinteractions make results inconclusive – new setup is being prepared, with increased training



Performed in collaboration with Erhvervsakademi Midtvest

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Which food product types relevant?

- Which food product types are relevant?

  Focus on **baked goods**, (rye bread, crackers)
  (using buffalo larvae meal, 58.6% protein)

- Consumer testing:

  i) some disliking at high inclusion levels
  ii) **general acceptance** as appropriate product category

Table 2
Nutritional information pr. 100 g - Rye bread

Larvae content	0%	10%	12%
Energy (kcal)	269	276	277
Fat	6.99	8.07	8.3
Saturated fatty acids	1.45	1.77	1.84
Monounsaturated fatty acids	2.08	2.07	2.07
Polyunsaturated fatty acids	3.22	3.16	3.15
Carbohydrate, available	40.0	37.2	36.7
Sugars, total	4.13	4.08	4.07
Dietary fiber	6.96	6.8	6.76
Protein	8.61	11	11.5
Salt, NaCl	1.38	1.38	1.38

- Insects have a distinct **umami** taste => less suitable in e.g. confectionary and breakfast products?

Collaboration with MSc student team on 'Thematic course in Food Innovation' @UCPH

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Consumer study

- Hall-test
- Food market in Copenhagen
- Mixed consumer group

	Total	Pita bread	Finnish flatbread	Corn pancake
Participants	77	56	48	50
Mean age in years (SD)	27.8 (9.4)	27.8 (9.5)	27.7 (9.5)	27.7 (9.5)
Gender				
Female	58.4%	60.7%	60.4%	54.0%
Male	41.6%	39.3%	39.6%	46.0%
Nationality				
Danish	42.9%	44.6%	37.5%	46.0%
Non-Danish	57.1%	55.4%	62.5%	54.0%
Food neophobia score				
Low	28.6%	28.6%	29.2%	28.0%
Medium	39.0%	39.3%	37.5%	40.0%
High	32.5%	32.1%	33.3%	32.0%

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Pita bread, finnish flatbread, and corn pancakes

- Colour differences
- Umami taste
- Slight bitterness

NUTRITIONAL INFORMATION

pr. 100 gr Finnish Bread

	0%	16%	21%
Energy (I			
Fat			
Saturate			
Carbohy			
Sugars, t			
Dietary f			
Protein			
Salt			

NUTRITIONAL INFORMATION

pr. 100 gr Pancake

	0%	11%	17%
Energy (Kcal)	312	335	341
Fat			
Saturate			
Carbohy			
Sugars,			
Dietary			
Protein			
Salt			

NUTRITIONAL INFORMATION

pr. 100 gr Pita Bread

	0%	14%
Energy (Kcal)	356	377
Fat	1,3	4,8
Saturated fatty acids	0,0	0,9
Carbohydrate	72,9	63,7
Sugars, total	3,7	3,6
Dietary fiber	4,6	4,6
Protein	11,5	17,9
Salt	1,0	1,0

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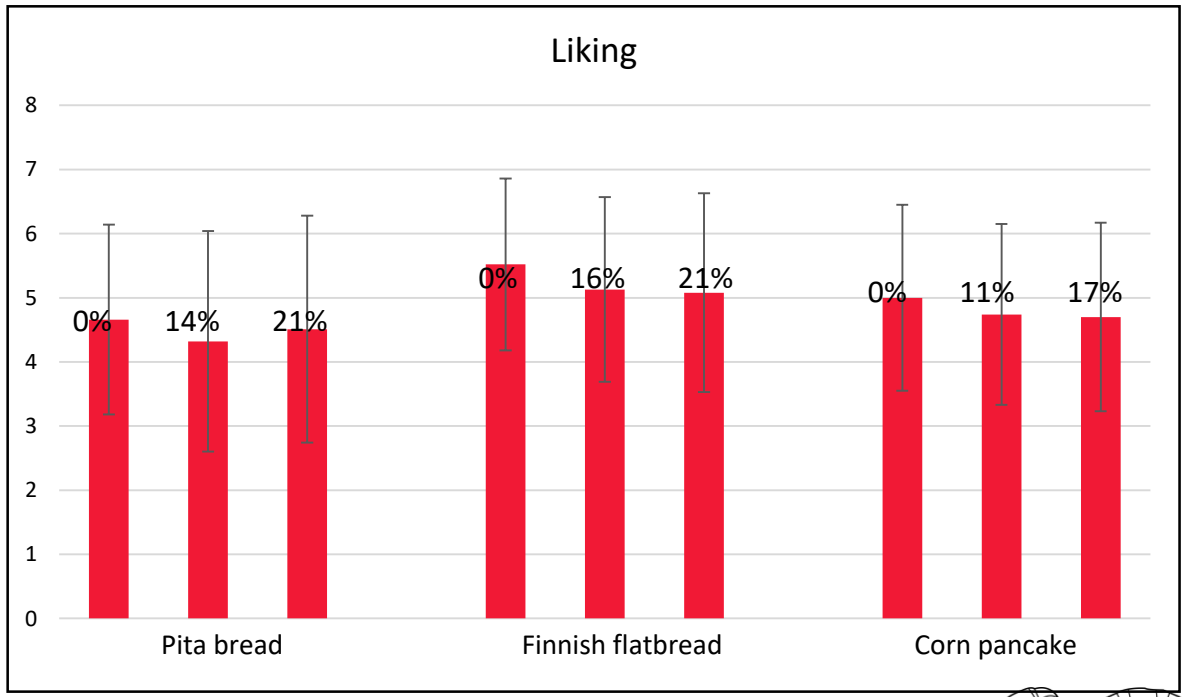
Consumer study

- Consumer liking on 1-7 scale
- Highest liking of finnish flatbread
- Not significant differences by adding insects
- Products containing insects are accepted by consumers



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Consumer study - product type

- Appropriateness of product type
- Questionnaire on addition of insects

- Finnish flatbread: 50%
- Pita bread: 38%
- Corn pancake: 27%

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- Focus on **'meal-related' insect-based foods** for lunch and/or dinner (e.g. spreads)
- **Convenience foods** (e.g. quiche)
- Assessment of **potential consumer** profile

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Potential short-term consumer profile: ‘The conscious consumer’

- Medium to high **educational level**
- Medium to high **socioeconomic status**
- Lives in more **urbanized** residential areas
- Food **neophilic**
- **Convenience** orientation

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Consumer values and triggers

- **Sustainability** (climate, environment, social, ethics), *story telling*, **healthy**, **local/regional produce**, less concerned with money than vision/values

- 'Ism'-driven, e.g. nutritionism and/or environmentalism – **'good karma'** – feeling good about what they are eating, being kind to themselves and the environment

- **Intergenerational** – passing along healthy and sustainable foods to their children

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Problems when replacing wheat flour with insect flour

- Replacing wheat and whole wheat flour in bun recipe with tenebrio flour
- 2 versions: Full fat tenebrio flour and 50% defatted Tenebrio flour
  - Full fat: 39.8% fat
  - Defatted: 19.8% fat*
- Aim: Produce a bread with at least 20% energy from protein

- *not for consumption

Collaboration with Mette Holse from Novozymes

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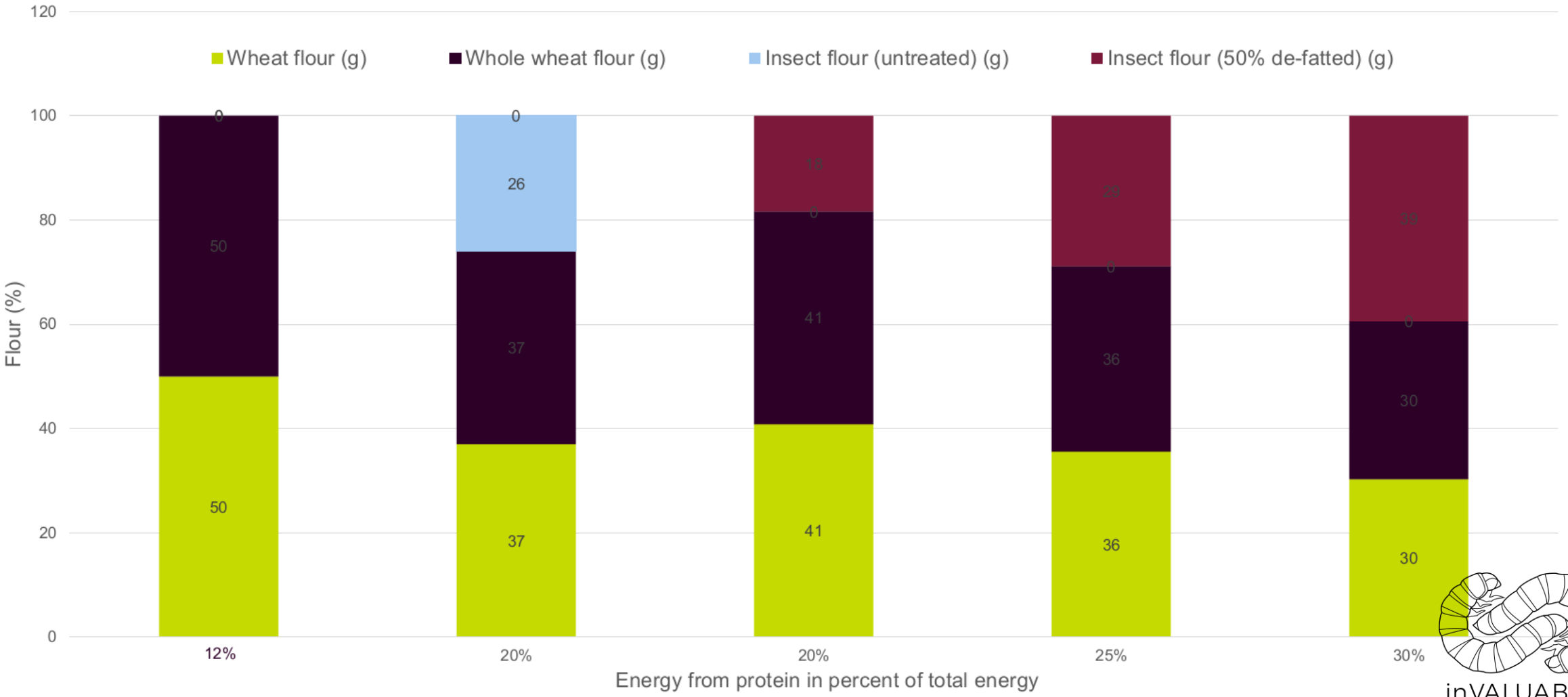

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Reduced raising ability

- 20% chosen to continue, as 25% and 30% became too sticky

Control	20 %	25 %	30 %	20 % Not de-fatted

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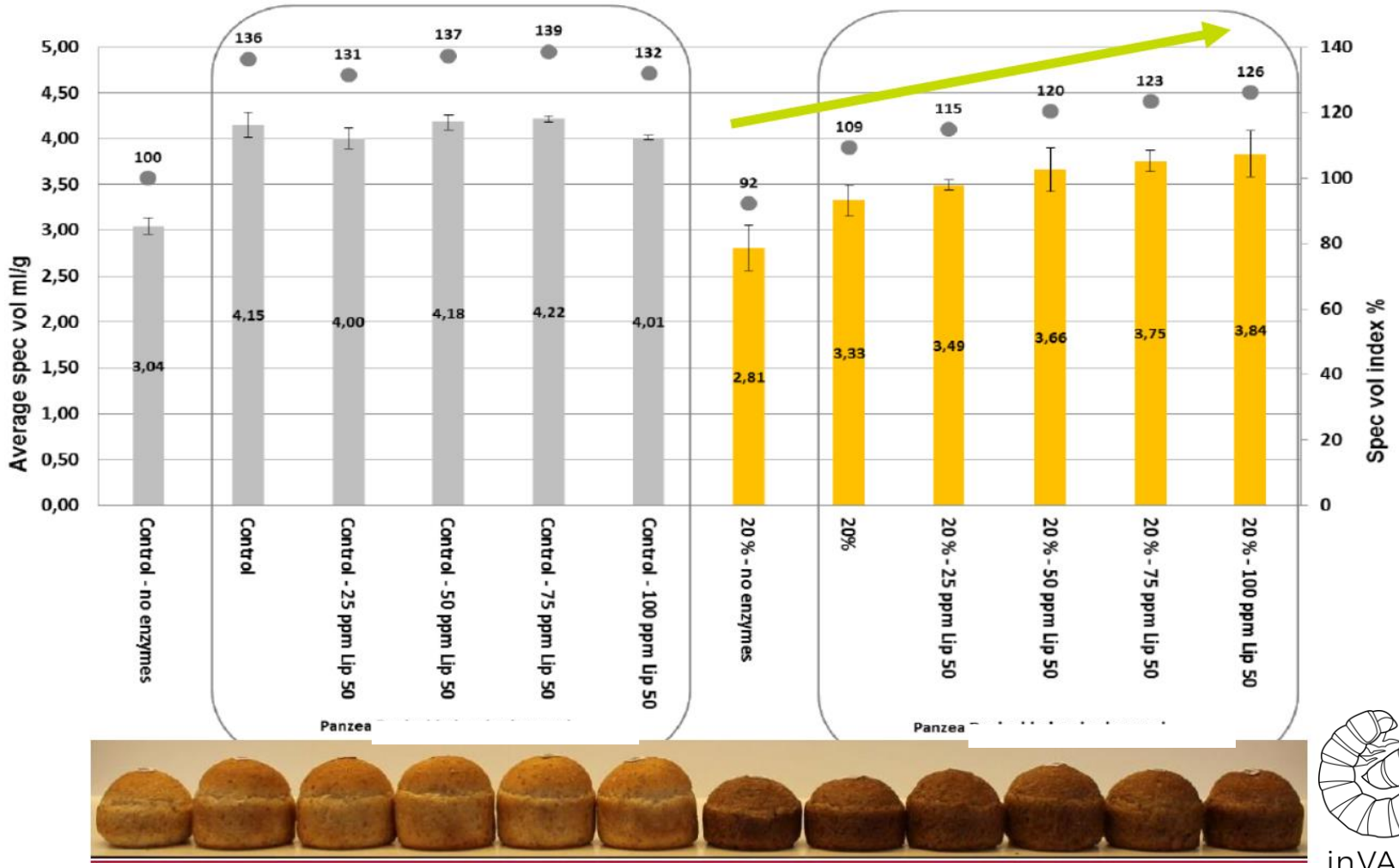
Test with lipases

- Controls with enzyme but no Tenebrio flour
- Increase in raising abilities with increase in enzyme concentration



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Future perspectives in food product development

- **Short-term (now?)**
  - 'Hybrid products' (e.g. plant-, meat- or dairy-based products fused with insects)
  - Extruded products

- **Long-term (10 years?)**
  - When consumers have generally accepted insect ingredients in food products… then 'more exotic' insects species may be introduced…

Fly larvae protein

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Questions

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