

SUSFOOD/EFFoST

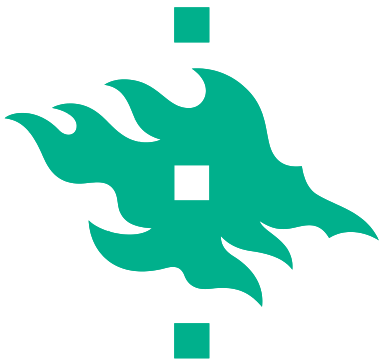
14 November 2017



Novel multifunctional plant protein ingredients with bioprocessing BIOPROT

Rossana Coda

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Project: 2 Innovation in food processing technologies and food products to support a sustainable food chain

2014-2016



1. University of Helsinki, Finland (coordination)

Kati Katina, Rossana Coda, Elisa Arte



2. VTT, Finland

Arja Laitila, Nesli Sozer, Riikka Juvonen



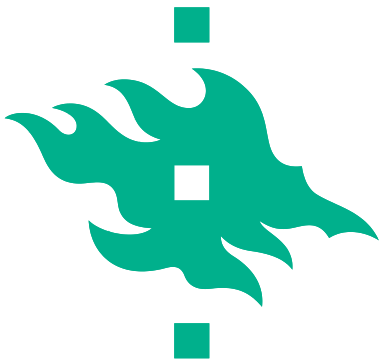
3. University of Bari, Italy

Marco Gobbetti, Carlo G. Rizzello



4. Central Research Institute of Food and Feed Control, Turkey

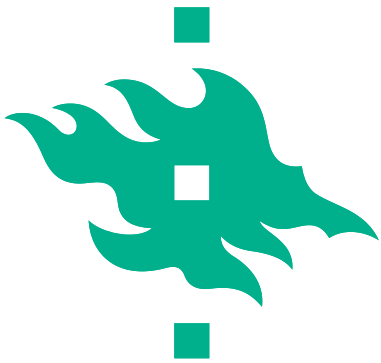
Orhan Erhen, Nurcan Aysar Guzelsoy



Background

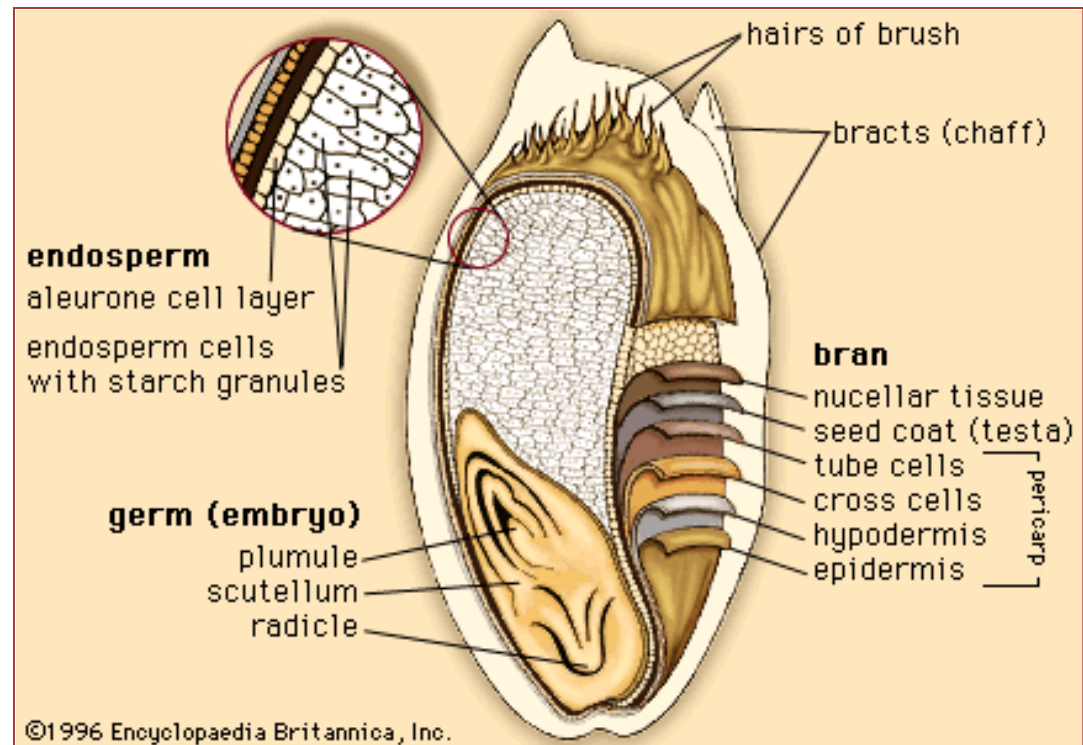
Wheat bran and faba bean are plant protein sources not currently utilized efficiently due to intrinsic matrix characteristics in both raw materials.

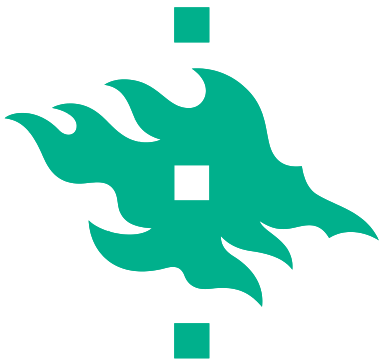




For wheat bran, protein usability is restricted due to location of protein inside aleurone cell walls.

- Wheat bran is rich in proteins (up to 20%) and fibers (up to 50%)
- Most of the bran is still discarded





For faba bean (*Vicia faba* L.), presence of anti-nutritional factors severely limits its use as food and feed.

Nutritional profile

- ✓ Carbohydrates: 50-60%
- ✓ Starch: 40%
- ✓ Dietary fiber: 7-10%
- ✓ Protein: 24-36%
30% lysine-rich protein



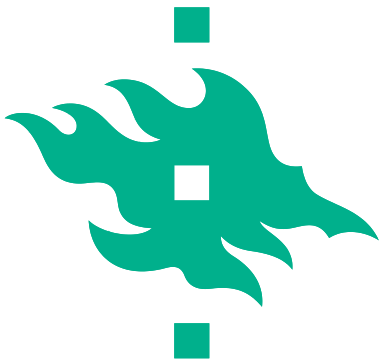
Ecological benefits:

- ✓ Positive effects on the environment
- ✓ Potential to replace imports of soybean meal
- ✓ Greatest ecological effects when consumed by humans

Antinutritional factors

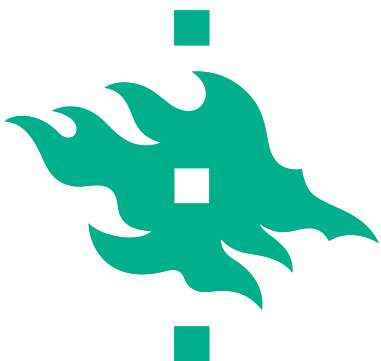
raffinose family oligosaccharides (α -galactosides): raffinose, stachyose, verbascose
condensed tannins, enzyme inhibitors (trypsin)
phytic acid

Vicine and Convicine (favism)

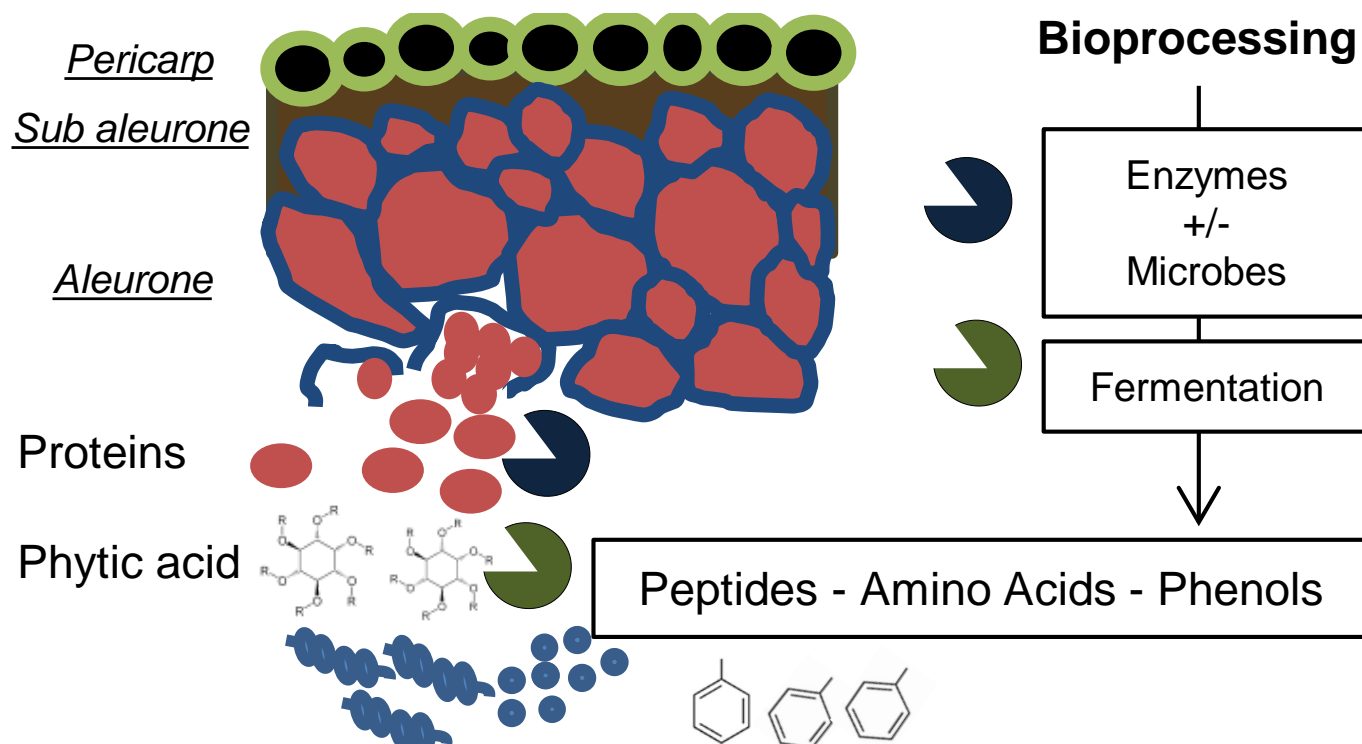


Objectives

1. Improve protein nutritional functionality of bran and faba bean and decrease the content of anti-nutritional factors with bioprocessing technologies
2. Establish the technological functionality of modified plant protein sources in different food applications.



Results: protein release from wheat bran



- 52% of solubilized N
- *In vitro* protein digestibility: 39% vs. 14%

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Article

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Impact of Enzymatic and Microbial Bioprocessing on Protein Modification and Nutritional Properties of Wheat Bran

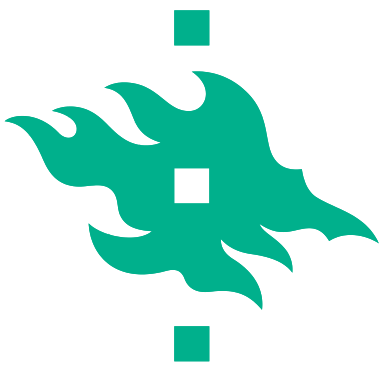
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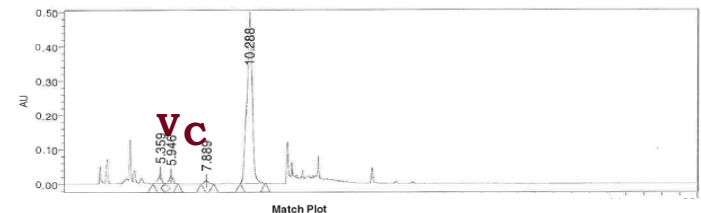
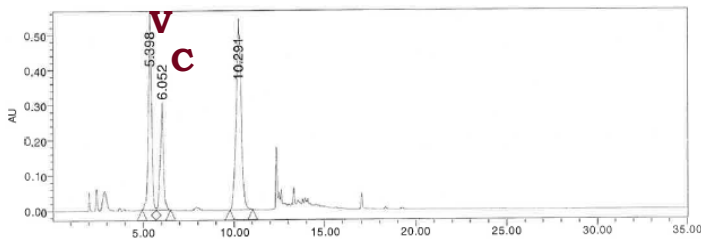
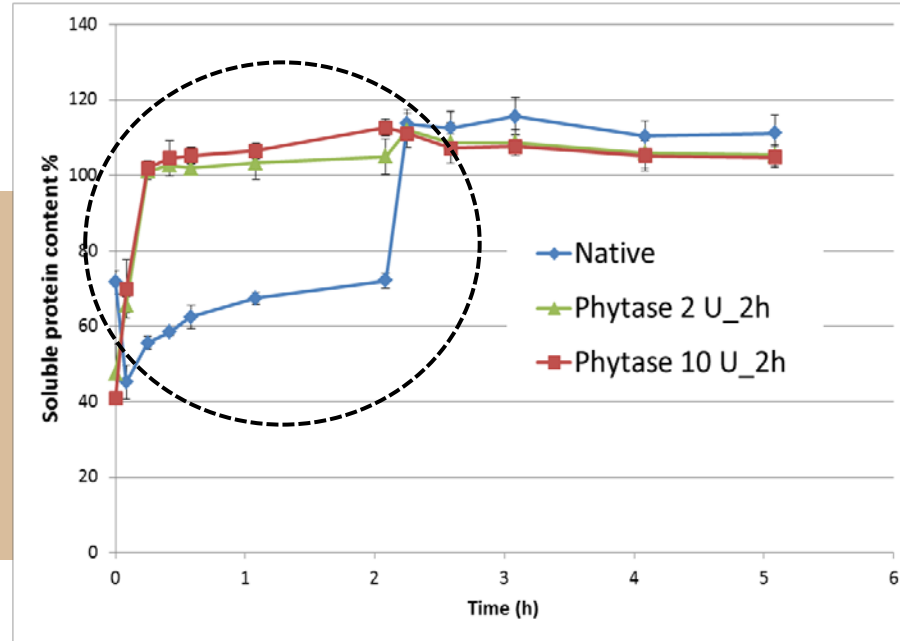
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Results: protein release and decrease of ANF in faba bean



Phytase treatment :

- 80% of phytate degraded
- enhanced the solubilisation and release of protein (*in vitro* model)
- increased Ca, Mg, Fe, Zn availability



Fermentation with *L. plantarum*:

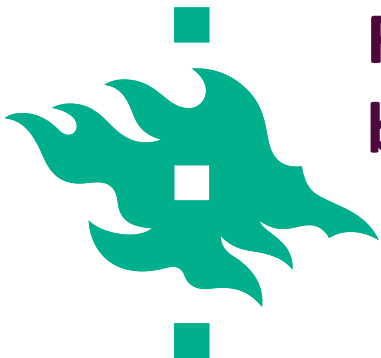
- Decrease of V and C of 90-95%

OPEN Degradation of vicine, convicine and their aglycones during fermentation of faba bean flour

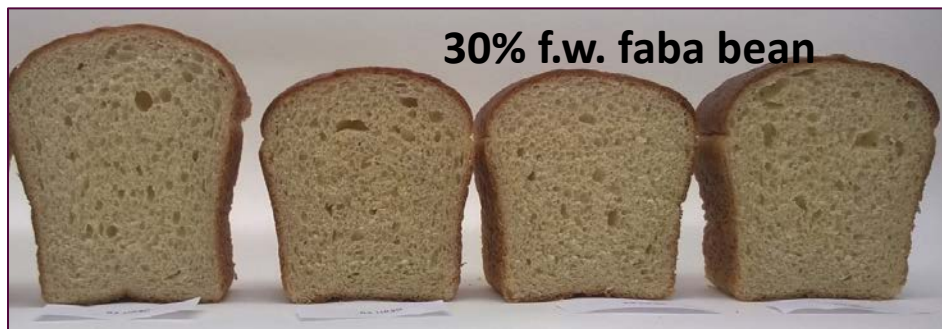
Received: 07 March 2016
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Carlo Giuseppe Rizzello¹, Ilario Losito^{2,3}, Laura Facchini², Kati Katina⁴,
Francesco Palmisano^{2,3}, Marco Gobbetti^{1,3} & Rossana Coda⁴

Results: technological/nutritional properties of bioprocessed faba bean



	WCB	NFB	FSB
IVPD	64.1 ± 2.1 ^b	63.6 ± 1.5 ^b	74.1 ± 1.9 ^a
EAA Index	68.7 ± 2.3 ^a	68.0 ± 2.1 ^a	75.4 ± 1.4 ^a
BV Index	63.2 ± 1.5 ^b	62.5 ± 2.7 ^b	71.8 ± 2.3 ^a
PER	18.5 ± 2.2 ^b	24.7 ± 2.1 ^a	26.8 ± 1.8 ^a
NI	16.9 ± 2.4 ^a	19.5 ± 1.8 ^a	23.7 ± 2.3 ^a
HI (%)	100	94 ± 0.64 ^b	81 ± 0.50 ^c
pGI (%)	94.6 ± 0 ^a	91.4 ± 0.2 ^b	84.2 ± 0.41 ^c



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

LWT - Food Science and Technology

journal homepage: www.elsevier.com/locate/lwt

Improvement of the protein quality of wheat bread through faba bean sourdough addition

Rossana Coda^a, Jutta Varis^a, Michela Verni^b, Carlo G. Rizzello^{b,*}, Kati Katina^a

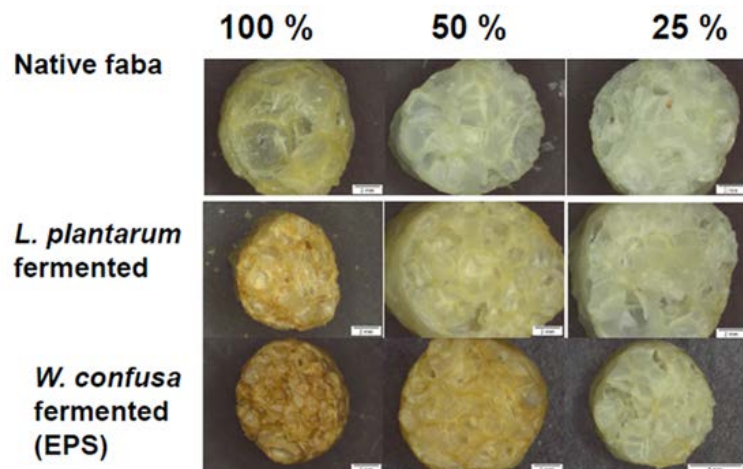
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Results: technological/nutritional properties of bioprocessed matrix

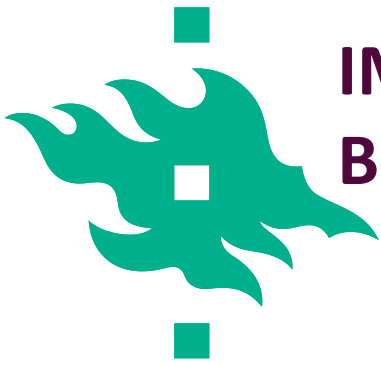
- 30% replacement of semolina with fermented faba bean flour improved the nutritional profile (IVPD: 76.5% vs 42% of semolina pasta)
- Fermentation increased essential amino acid index, biological value, resistant starch content

Influence of fermented faba bean flour on the nutritional, technological and sensory quality of fortified pasta†

Carlo G. Rizzello,^a Michela Verni,^a Hanna Koivula,^b Marco Montemurro,^a Laila Seppa,^{b,c} Marianna Kemell,^d Kati Katina,^b Rossana Coda*^b and Marco Gobbetti^a



At addition level of 25 %, fermentation with *L. plantarum* improved mechanical properties of extruded snacks: 55 % increase in crispiness index and 45 % reduced hardness



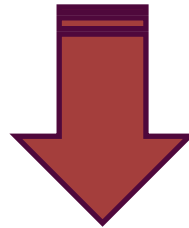
IMPACT: Outcomes and development of BIOPROT activities

High potential of bioprocessing technologies

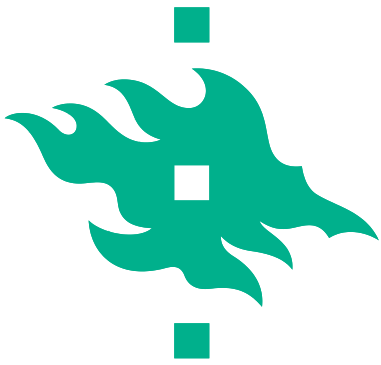
Successful dissemination

5 joint publications and several conference contributions

Doctoral study on wheat bran protein functionality (completion 2018-2019)



- ✓ **Industrial follow up on wheat bran protein exploitation**
- ✓ **Networking: approach “from farm to fork” on faba bean use**



ACKNOWLEDGEMENTS

All our collaborators

Thank you for your attention

“Novel multifunctional plant protein ingredients with bioprocessing “
BIOPROT

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