Optimising faba bean tempeh production: understanding how fermentation and cooking affect protein nutritional quality and sensory attributes

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1 Background

1.The low protein nutritional quality of faba beans limits their application as an alternative source of proteins.

2.One strategy to overcome this limitation is to apply fermentation.

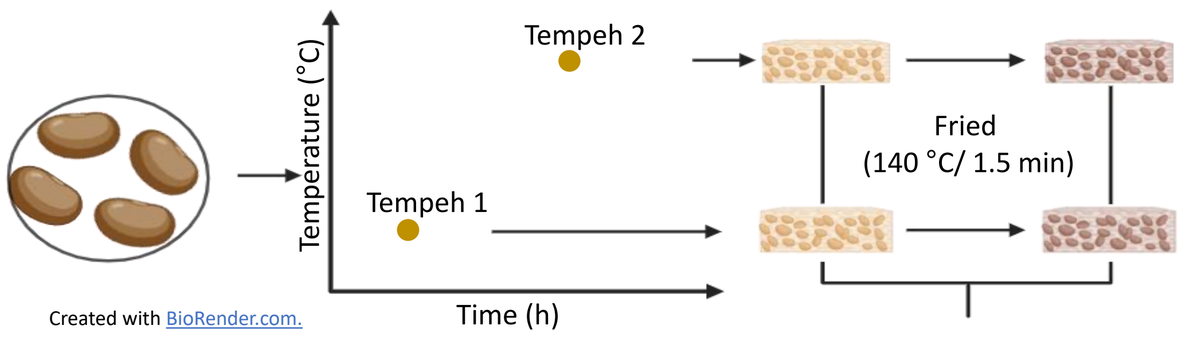
3.Tempeh production can be used to improve the nutritional quality of plant proteins.

2 Aim

To investigate the impact of fermentation conditions and cooking on the protein nutritional quality and sensory attributes of faba bean tempeh.

3 Material & Methods

Faba beans → Fermentation conditions → Cooking



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Analyses
- Static *in vitro* protein digestibility
- Amino acid profile (LC-MS/MS)
- Peptide identification (LC-MS/MS)
- Sensory descriptive analysis

5 Conclusions

Fermentation conditions

High temperature & time
- Improved *in vitro* protein digestibility.
- High peptide intensity.
- Improved essential amino acid profile.


Fresh

Cooking


Cooked
- No substantial effect on the protein nutritional quality.

Sensory quality


Cooked
- Fermentation did not affect the sensory quality.

4 Results

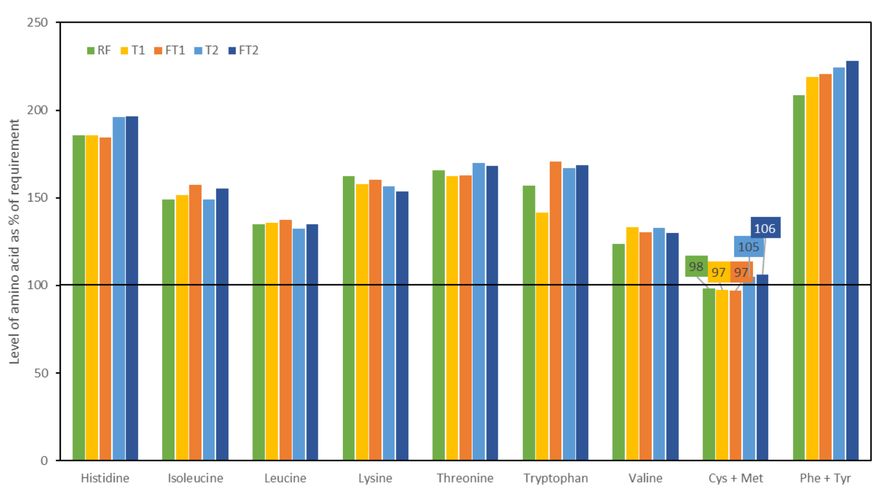
In vitro protein digestibility of faba beans and tempehs (fresh and cooked)

Levels of essential amino acids

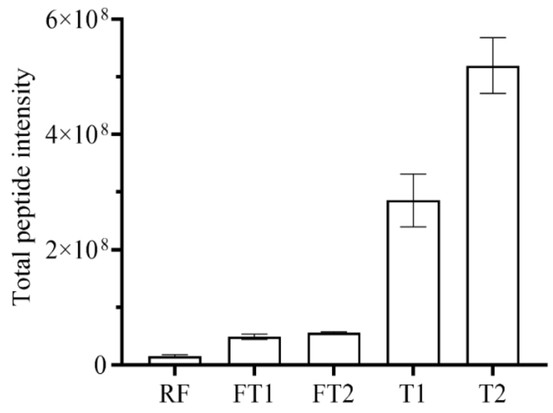
Peptide intensity

Protein hydrolysis (%)				
Sample	**Before *in vitro* digestion**	**During gastric phase (1 h)**	**During intestinal phase (1 h)**	**Total - before & during (2 h)**
Faba bean	2.11 ± 0.06^{d}	4.58 ± 0.21^{bc}	14.20 ± 0.27^{ac}	20.89 ± 0.40^{c}
Tempeh 1	5.55 ± 0.19^{b}	3.49 ± 0.29^{d}	14.90 ± 1.56^{abd}	23.95 ± 1.71^{ac}
Tempeh 2	8.93 ± 0.72^{a}	4.28 ± 0.24^{c}	12.82 ± 0.41^{b}	26.03 ± 0.71^{a}
Fried tempeh 1	4.76 ± 0.16^{c}	3.82 ± 0.39^{cd}	13.59 ± 0.93^{bcd}	22.16 ± 1.13^{bc}
Fried tempeh 2	7.88 ± 0.49^{a}	4.93 ± 0.11^{b}	11.86 ± 0.27^{d}	24.66 ± 0.29^{ab}
BSA	0.72 ± 0.04^{e}	7.53 ± 0.10^{a}	20.09 ± 2.59^{a}	28.34 ± 2.56^{a}

Results are given as mean ± standard deviation (n = 3). The means were compared using a two-tailed, unpaired student´s t-test. Values having different superscripts in the same column differ significantly ($p < 0.05$). BSA= bovine serum albumin (reference protein).



Levels of essential amino acids of faba beans and tempehs as a percentage of the adult requirement for each amino acid[1].The amino acid score of the most limiting essential amino acid is shown in the figure.



Raw faba bean (RF), tempehs (T1 and T2), fried tempehs (FT1 and FT2)

Reference : 1. WHO, FAO, & UNU (Eds.). (2007). Protein and amino acid requirements in human nutrition: Report of a joint WHO/FAO/UNU Expert Consultation, [Geneva, 9 - 16 April 2002]. WHO.

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