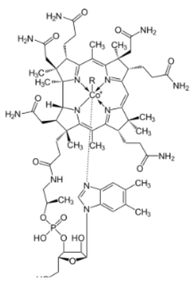
Plant-based product fermentation for vitamin B12 fortification

Fermentation as tool to naturally enrich plant-based co-products high in protein content to create meat-alternatives with vitamin B12

Hermien van Bokhorst-van de Veen, Mariette Helmond, Luciënne Berendsen and Masja Nierop Groot – Wageningen Food & Biobased Research

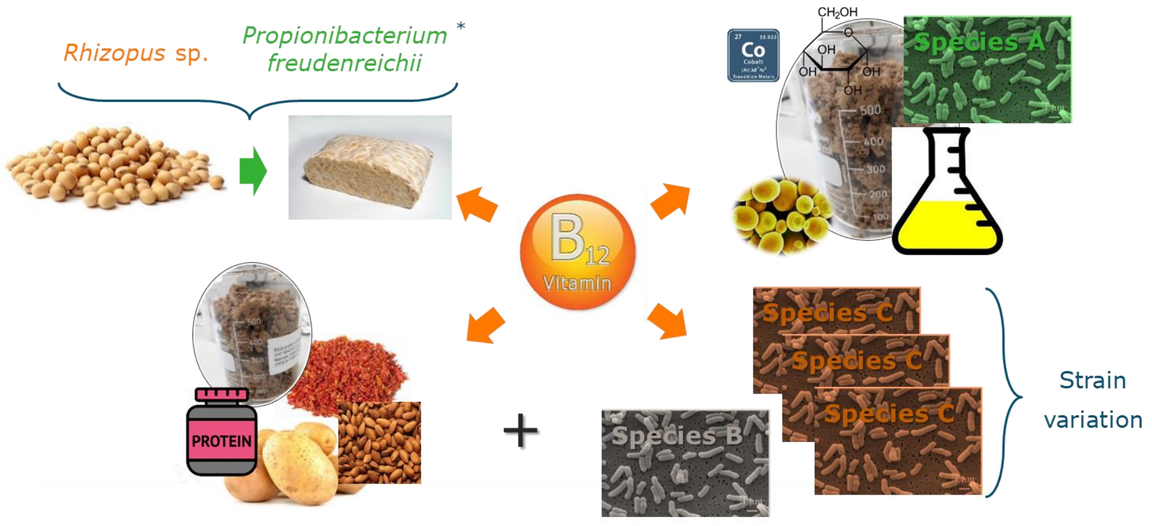
Background

- Vitamin B12 (vitB12) is essential for human health
- It is only available in animal-derived products or supplements
- It is only produced *de novo* by microorganisms



Project aim: to fortify plant-based protein-rich (co-) products with vitB12 using fermentation

Approach



*Wolkers – Rooijackers, J. C. M., Endika, M. F., & Smid, E. J. (2018)

Results

Vitamin B12 content after solid-state fermentation:

Sample	*Pf** added	VitB12 (µg/100g ww or dw)
Chickpea + plant-material X	Yes	2.98 ± 0.03 / 7.42 ± 0.09
Chickpea + plant-material X	No	BD (<0.1 / <0.3)
Chickpea + plant-material X and Y	Yes	3.18 ± 0.17 / 7.75 ± 0.28
Chickpea + plant-material X and Y	No	BD (<0.1 / <0.3)
Chickpea + plant-material X and Z	Yes	1.36 ± 0.03 / 3.26 ± 0.09
Chickpea + plant-material X and Z	No	BD (<0.1 / <0.3)

**Propionibacterium freudenreichii*; colony-forming-unit levels were stable or increased during fermentation

ww wet weight
dw dry weight
BD below detection level

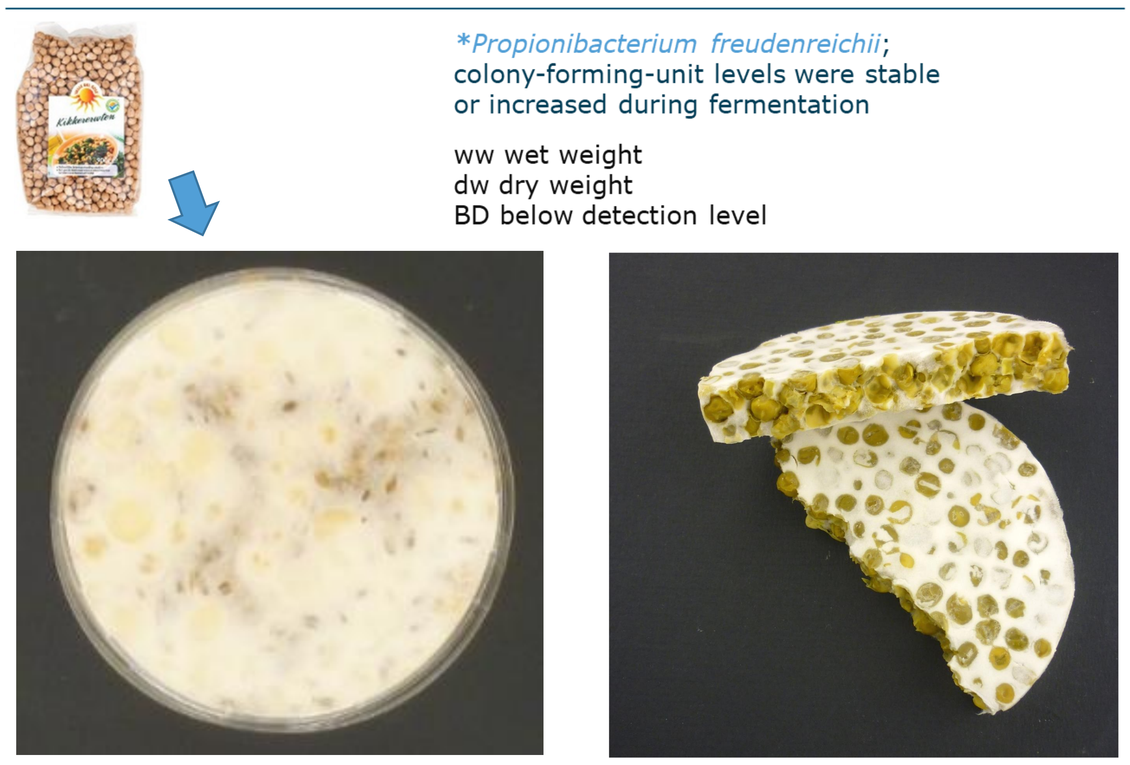
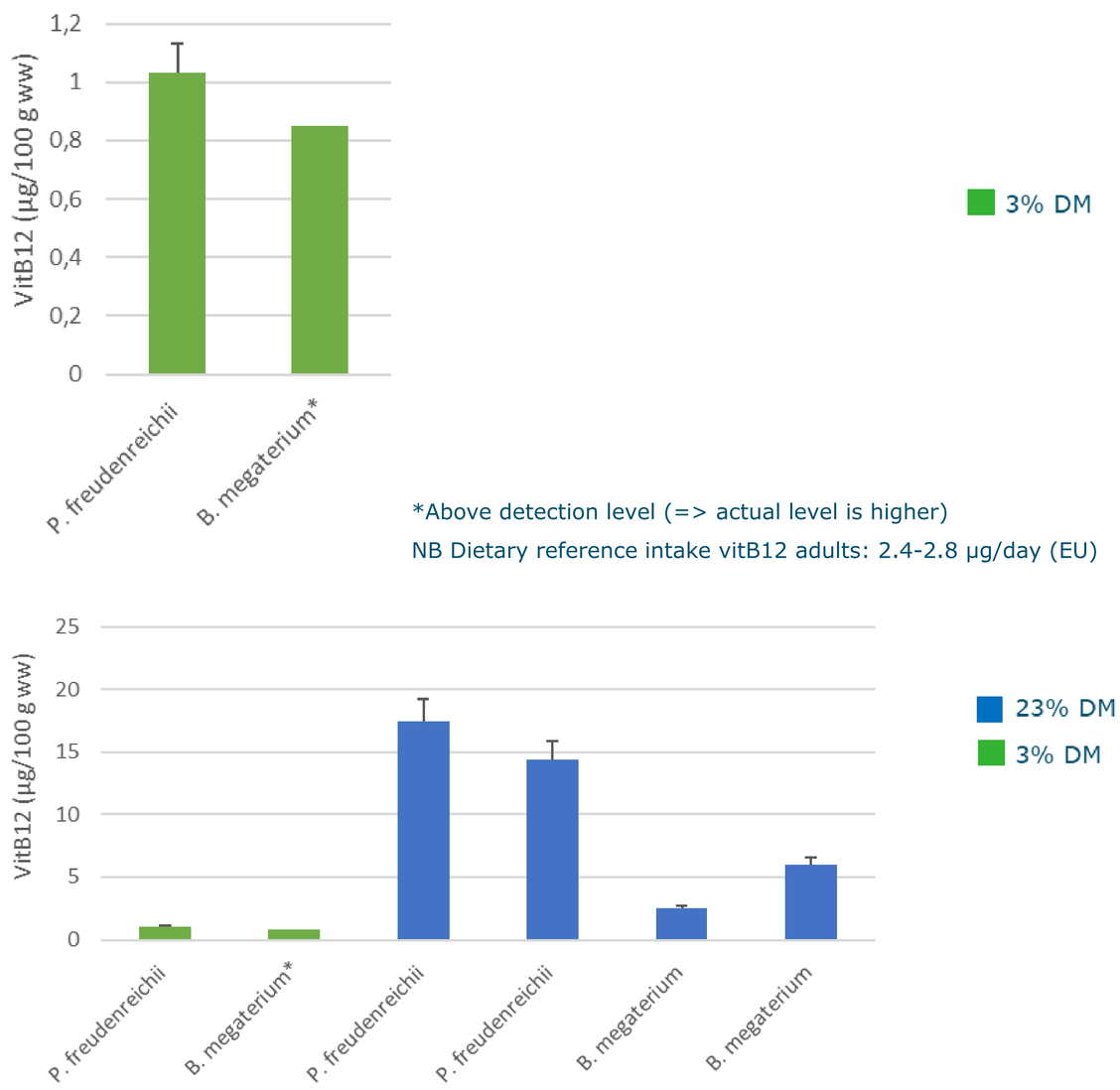


Figure 1. Examples tempeh and lupeh alternatives: fermented chickpeas and plant material X using *Rhizopus* spp. and *P. freudenreichii* (left) and fresh peas using *Rhizopus* spp. (right).

Vitamin B12 content after submerged fermentation varying dry matter content (DM):

Figure 2. Vitamin B12 concentration in fermented plant-based protein-rich co-products (side-stream food products) using food-grade bacteria. ww wet weight; DM dry matter content.



*Above detection level (=> actual level is higher)

NB Dietary reference intake vitB12 adults: 2.4-2.8 µg/day (EU)

Figure 3. Vitamin B12 concentration in fermented plant-based protein-rich co-products (side-stream food products) using food-grade bacteria. ww wet weight; DM dry matter content.

Conclusions

- Vitamin B12 is detected in nutritionally relevant concentrations:
  - In tempeh and lupeh alternatives (up to 3.0 µg/100 g ww vitB12)
  - In submerged or semi-solid fermented high protein co-products (up to 17.5 µg/100 g ww vitB12)
- Fermentation can be applied as tool to fortify protein-rich plant-based products that contain vitamin B12 levels equal to animal-derived products

Acknowledgements

We greatly acknowledge:
- Tom Verhoek, Marcel Lommers and Derk van Manen (Duynie Group, the Netherlands) for co-product supplementation,
- Kees van Kekem, Ondino Azario, Helene Mocking and Walter Heijnis (Wageningen Univeristy & Research, the Netherlands) for HPLC analyses and
- Jacqueline Berghout (Wageningen Univeristy & Research, the Netherlands) for project coordination

Wageningen University & Research
P.O. Box 123, 6700 AB Wageningen
Contact: hermien.vanbokhorst@wur.nl
T + 31 (0)317 48 01 98, M +31 (0)6 10 93 44 88
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