

From spore to spoiler: germination of meat spoilage related clostridia

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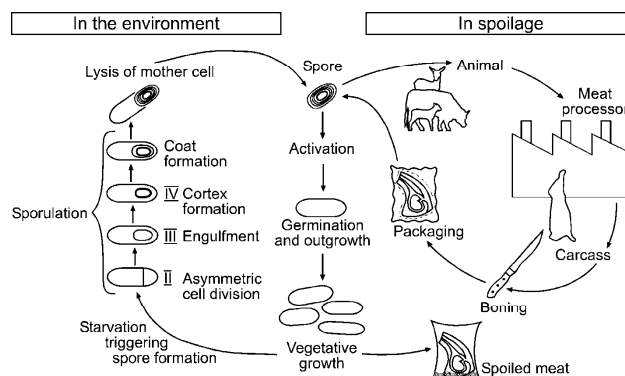
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TE PŪNAHA HIRINGA WHAKAEA

Spoilage by psychrotolerant clostridia

- On opening the pack highly objectionable off odours are easily detected.
- The vacuum-pack contains copious quantities of drip.
- The vacuum-pack is often distended due to the presence of gas.



How spores become spoilers

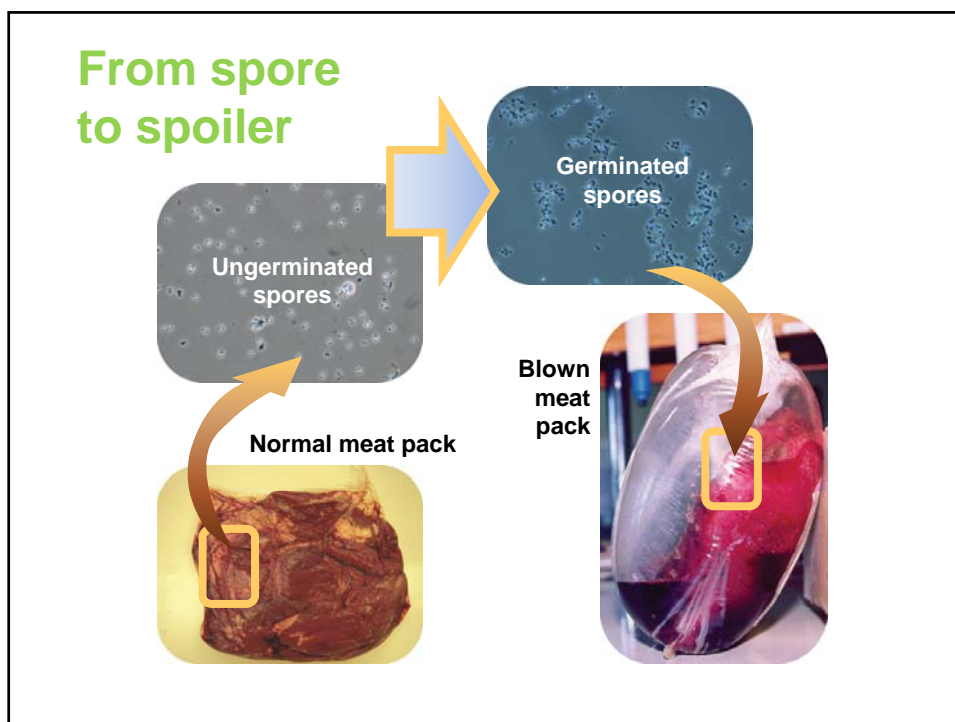


From: Adam, K.H., Flint, S.H. and Brightwell, G. (2010) Psychrophilic and psychrotrophic clostridia: sporulation and germination processes and their role in the spoilage of chilled, vacuum-packaged beef, lamb and venison. *International Journal of Food Science & Technology* **45**, 1539-1544.

Psychrotolerant clostridia are:

- Strict anaerobes (do not grow in the presence of oxygen).
- Able to grow at cold temperatures (down to -1.5°C).
- Spore formers.
- Present in soil.
- Very low inoculum needed to cause spoilage.
- Comprise a number of strains including *C. estertheticum*.





Aim

To determine the triggers of germination in psychrophilic and psychrotrophic clostridia associated with spoilage of vacuum-packaged New Zealand red meat.

Outcome

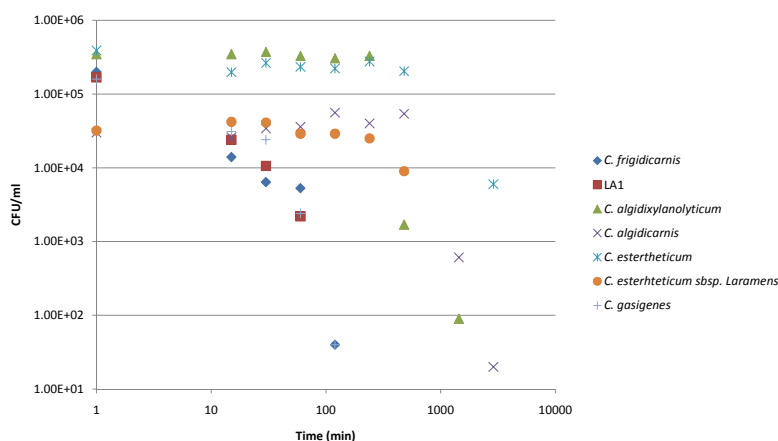
To reduce spoilage by psychrotolerant clostridia by inducing spore germination and killing cells prior to packaging.

Previous Findings

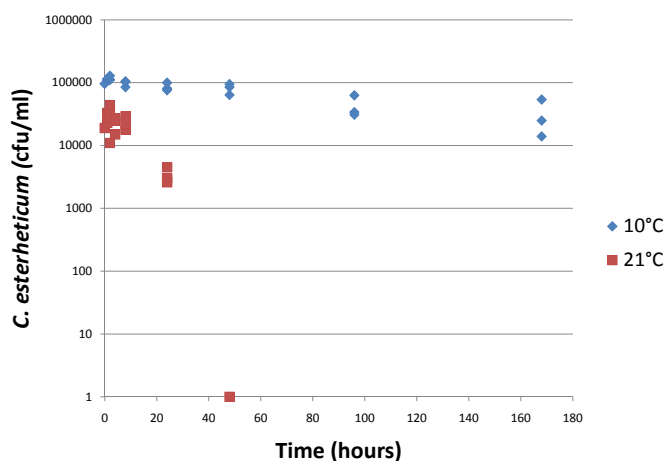
- A germination system was identified in *C. frigidicarnis* (lactate + valine, or lactate + norvaline)*.
- The effects of temperature, pH, salt concentration and atmosphere on germination of *C. frigidicarnis* were determined.
- The extent of germination in laboratory produced *C. estertheticum* was found to be too low to measure using OD or microscopy.

* Adam, K.H., Brunt, J., Brightwell, G., Flint, S.H. and Peck, M.W. (2011) Spore germination of the psychrotolerant, red meat spoiler, *Clostridium frigidicarnis*. *Letters in Applied Microbiology*

Oxygen sensitivity of vegetative cells



Oxygen sensitivity in *C. estertheticum*



Implications

- Exposing freshly germinated cells to oxygen is unlikely to be a practical means of killing them.
- Vegetative cells are likely to persist in soils for much longer than anticipated even when exposed to air.

Future work

- Investigate flow cytometry as a method of identifying the triggers of germination in *C. estertheticum*.
- Investigate methods of killing freshly germinated spores on red meat.

Thank you and questions

- Thank you to the Ministry of Science and Innovation for supporting this project.

