High Pressure Processing (HPP)

INTERVENTION SUMMARY	
Status	An emerging technology
Location	Packaging/retail packs
Intervention type	Full thickness treatment of packaged product
Treatment time	0.5-5 minutes
Regulations	No specific restrictions in EU, US or Australia
Effectiveness	Up to 4 log reduction
Likely cost	High capital outlay
Value for money	Viable for ready-to-eat meat products at present
Plant or process changes	The equipment required is quite large
Environmental impact	Utilises energy to achieve pressure increase
OH&S	Noise production
Advantages	Less use of preservatives such as lactates or salt for processed meat products. Potential for manufacture of new, minimally processed ready-to-eat meat products. Good consumer acceptance likely as no additives are needed Penetrates full thickness of product, so is ideal for comminute product
Disadvantages or limitations	Possible meat colour/texture changes on raw meat products and increased oxidation of lipids Product must be packaged. Only specific packaging types may be used that can withstand the HPP treatment

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High pressure processing (HPP) involves submerging the (normally) packaged food in a liquid (usually water) within an enclosed vessel. The pressure is then generated either by pumping more liquid into the pressure vessel or by reducing the volume of the pressure chamber.

HPP kills microorganisms by interrupting their cellular function without the need for heat. Such process can enhance the safety of products and extend their shelf life. When appropriately used, HPP also does not alter the texture, appearance or flavour of foods.

Application of HPP for meat and meat products was reviewed by Hugas *et al.* (2002) and Simonin *et al*. (2012). Pressures ranging from 101 to 1,013 MPa have been explored as potential food safety treatments for meat, although pressures ≥300 MPa appear to cause more rapid lipid oxidation (Cheah and Ledward, 1996). It has been demonstrated that HPP treatment of ground beef caused substantial reductions (>5 log units) of *Pseudomonas fluorescens* (at ≥200 MPa), *Citrobacter freundii* (at ≥280 MPa) and *L. innocua* (at ≥400 MPa) (Carlez *et al.*, 1993). The treatment also slowed the development of spoilage organisms during subsequent storage of ground beef (Carlez *et al.*, 1994). Similarly, Black *et al*. (2010) found that HPP treatment of ground beef at 400 MPa for 10 minutes reduced *E. coli* O157:H7 by 3 log cfu/g, and caused sub-lethal injury resulting in further reductions during frozen storage.

HPP is a very promising technology for ready-to-eat meats. This is because there are few barriers to approval by regulatory authorities, i.e. no special labelling requirements because no chemicals are used; and if used appropriately there are no changes to texture or flavour of the product. Researchers found that in RTE meats pressure treated at 600 MPa at 20°C for 180 seconds, there was no deterioration in sensory quality, no difference in consumer acceptability, and a 4-log reduction in *L. monocytogenes* and *E. coli* O157 in inoculated product, and the refrigerated shelf life was extended (Hayman *et al*., 2004, Gill and Ramaswamy, 2008). Treatment of dry-fermented sausage 600 MPa reduced *E. coli* by approximately 3 log units (Omer *et al*., 2010). Hugas *et al*. (2002) and Han *et al*. (2010) reported that HPP treatment (600 MPa for 10 minutes at 30°C or 400 MPa at 22°C) could extend the shelf life of food including cooked ham, dry cured ham and marinated beef loins.

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