Microbiological studies of Value-added pork products

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Background

Fresh pork retail cuts packaged under 100% CO_2 have been shown to have a shelf life of up to 10 weeks when stored at –1.5°C (Bobbitt *et al*, 1997). There is limited use of modified atmosphere packaging using 100% CO_2 in the production of meal-ready pork products in Australia, with the majority of Australia's fresh pig meat production sold as basic cuts with little added value. Two ready-to-cook pork products were developed which were flavoured with indigenous spices, herbs and fruits with the intention of promoting the unique flavours of these Australian ingredients. These products were packaged in an atmosphere of 100% CO_2, and evaluated microbiologically, both for potentially pathogenic organisms and to determine the likely shelf life of the products.

Objectives

The objectives of this project were:

- to develop value added pork products using indigenous flavourings suitable for both domestic and export markets.
- to assess the microbiological safety and shelf life of these products.
- to send trial consignments to niche market retailers for comments, in view of the possible commercialisation of the project.

Materials and Methods

The Australian flavours used in this project were chosen following an informal taste panel involving approximately 40 participants. Two products were developed further and assessed for microbiological safety and shelf life. The first of these was a pork neck steak product coated in a Cajun-style "Wildfire spice mix" containing pepperberry and mountain pepper (both native to Australia) with other spices, where the spice mix is used as a dry coat for the meat. The second product was a rolled loin roast containing lemon myrtle powder: lemon myrtle is a plant native to Queensland with intensely citrus-like flavoured leaves. These flavours are produced commercially by Cherikoff Pty. Ltd, Australia.

The products for microbiological analysis were manufactured under commercial conditions, packaged in Cryovac trays and gas flushed with 100% CO_2. There have been reports of higher drip loss reported in pork products packaged under 100% CO_2 (Sørheim *et al*, 1996), and to reduce the appearance of drip in the packaging, absorbent pads (provided by cello paper Pty, Ltd, Australia) were included.

Commercial products were airfreighted to the testing laboratory under refrigerated conditions for sampling and storage at 4°C. Samples collected from these products were processed, cultured, and evaluated according to previously published methods (Australian Standard, 1991 – 1998; MIRINZ, 1996). Microbiological testing included Total Viable Counts at 25°C (TVC25), testing for *Escherichia coli* and coliforms, *Staphylococcus aureus*, *Lactobacillus* spp., *Brochothrix* spp., and *Pseudomonas* spp. The testing method for *Salmonella* spp. was an adaptation of the AS method in which Brilliant Green agar is substituted for Bismuth Sulphate agar. Microbial analysis was conducted on the same day as packaging and transport (day 0), and subsequently on days 8, 15 and 22.

Results and Discussion

Salmonella spp. was not detected on product tested at days 0, 8, 15 and 22. All samples were below the limit of detection for coagulase-positive *Staphylococci* and *Clostridium perfringens* at days 0,8,15 and 22. The lemon myrtle roast reached spoilage levels (approximately10 ^{7}cfu/g) of *Lactobacillus* spp. at between 15 and 22 days, while the pork steak with Wildfire spice mix reached spoilage levels of *Lactobacillus* spp. at 15 days (see Figure 1). This compares with the work of Gill and Harrison (1989), who found that pork loins stored under 100% CO_2 at 3°C reached maximal levels of *Lactobacillus* spp. (10^8 cfu/cm^2) at 3 weeks, with no significant change in this level over the remainder of the testing period. The products, however, were organoleptically unacceptable after 22 days storage. Results of other microbiological parameters are given in Table 1. The much shorter shelf life of these meal ready products, compared with our previous work with fresh retail cuts (Bobbitt *et al* 1997) reflects the increased handling that these products received.

E.coli levels were low for all samples, as were coliform levels. The low levels of coliforms at each stage of testing indicate that the hygiene of production was good. Although *Lactobacillus* spp. were the dominant spoilage organism during the shelf life trial (post day 0) growth of both *Pseudomonas* spp. and *Brochothrix* spp. were noted throughout the shelf life trial, and probably contributed to the organoleptic spoilage of the product. Inclusion of oxygen scavengers into this type of modified atmosphere packaged product has been shown to improve the product shelf life by inhibiting aerobic spoilage organisms, and reduce the colour deterioration of meat (Church, 1994) seen when metmyoglobin is produced. This typically occurs under aerobic storage or in MAP when oxygen concentrations are between 0.5 and 1% (Seidemann and Durland, 1984). It is possible that one or both of these products may have an extended shelf life if this technology were to be incorporated into packaging, and this is of particular interest to export markets.

Trial consignments of products were accepted by a number of retail outlets in Victoria. Products suitable for comarketing at a retail level, including pasta, chutneys and oils flavoured with complementary Australian spices, accompanied the pork products. The response from retailers was positive for the pork steak with wildfire spice mix. The lemon myrtle roast has met with mixed success.

Conclusions/Recommendations

Indigenous Australian flavours may be used to produce niche-market pork meal solutions for both the domestic and overseas consumer. The products have a practical shelf life of around 14 days at 4°C, with *Lactobacillus* spp. dominating the spoilage flora. Potential microbial pathogens were not isolated from the products. Incorporation of oxygen scavengers into the packaging may provide extended shelf life of these products, which is important for export markets.

Table 1: Microbial counts obtained during shelf life testing of pork products at 4°C (average log 10 colony forming units (cfu)/g).

Sample	TVC 25	Brochothrix spp.	Pseudomonas spp.	Lactobacillus spp.	coliforms
Lemon Myrtle Roast (day 0)	4.38	4.40	4.87	4.01	1.38
Lemon Myrtle Roast (day 8)	6.11	4.28	5.36	5.91	1.64
Lemon Myrtle Roast (day 15)	6.34	4.94	5.47	6.47	1.90
Lemon Myrtle Roast (day 22)	7.30	5.03	5.18	7.26	1.78
Pork steak with wildfire spice mix (day 0)	5.01	4.44	4.62	4.30	2.07
Pork steak with wildfire spice mix (day 8)	6.27	5.14	4.73	5.78	2.05
Pork steak with wildfire spice mix (day 15)	6.66	4.61	4.34	>6.97	1.53
Pork steak with wildfire spice mix (day 22)	7.78	4.65	4.39	8.68	1.84

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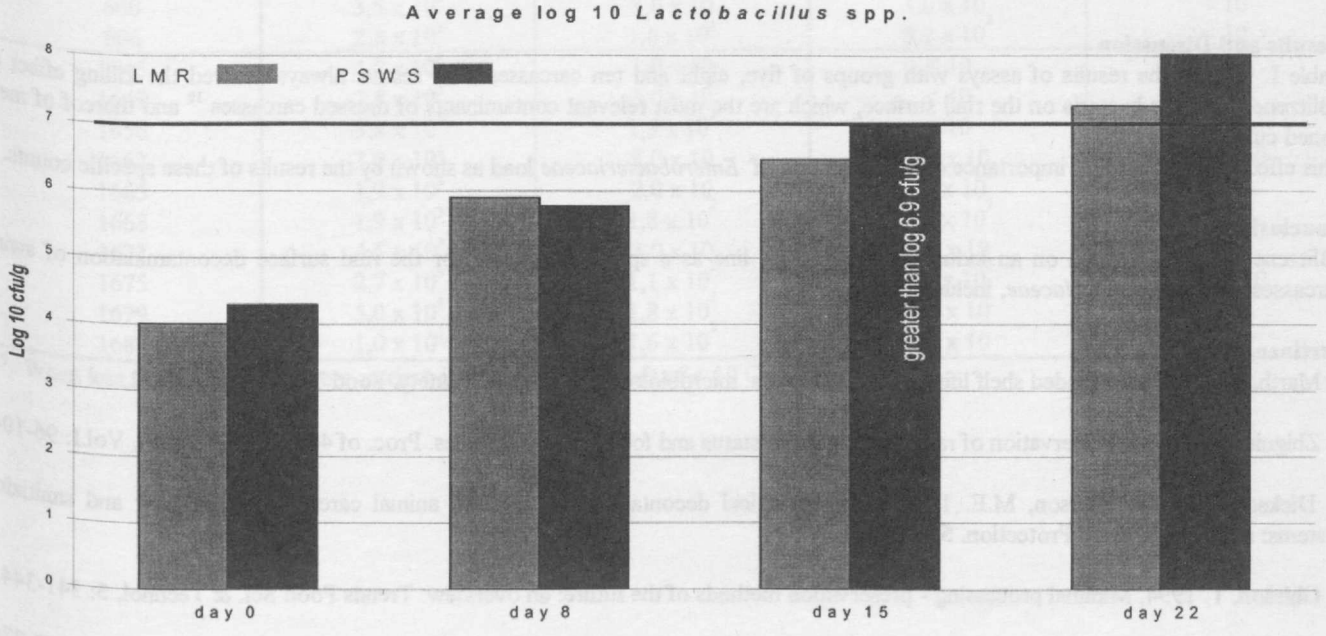
Figure 1: *Lactobacillus* spp. growth for both Lemon Myrtle Roast (LMR) and Pork steaks coated with Wildfire Spice Mix (PSWS) (average log 10 cfu/g)



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