

# SNAPSHOT

## IMPACT OF EXTENDED SHELF-LIFE OF CHILLED BEEF INTO OVERSEAS

### MARKETS

**Project Report Reference: 2016-1059**

**Date: 2 February 2018**

#### **Project Description**

Australia is a major exporter of vacuum packaged chilled beef (VPCB) to many overseas markets. China is an increasingly important export destination for Australian VPCB, with enormous potential for expansion. Providing high quality VPCB to Chinese consumers relies on excellent temperature control at all steps in the cold supply chain. Maintaining a temperature close to  $-1^{\circ}\text{C}$  is essential for an extended shelf-life. Even small increases in storage temperatures for extended periods are detrimental and significantly reduce meat quality and shelf-life. In some markets, a shelf life of 77 days or 11 weeks is the accepted limit, however previous research has demonstrated that 140-days (20 weeks) or even longer is achievable with optimal temperature control. An increased shelf-life for Australian VPCB would be of enormous benefit, allowing greater flexibility for distributors.

This project tested the robustness of the current cold supply chain, from the processing plant in Queensland, during shipping and through to distribution centres in China. VPCB was sent on three different trips in China to test variability in the cold supply chain. Control VPCB was also held at close to  $-1^{\circ}\text{C}$  at CSIRO for the entire experiment. Temperature profiles during transport was recorded from meat processor to final destination, using two different temperature loggers. Microbiological, biochemical and sensory testing of the VPCB was conducted after 84-days (12 weeks), 98-days (14 weeks), 120-days (17 weeks) and 140-days (20 weeks). Changes in total volatile basic nitrogen (TVB-N), a measure of meat quality was also performed. Additional measurements; fatty acids, volatiles and non-volatile metabolites were performed on CSIRO samples.

#### **Project Content**

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The project provides detailed information about typical temperature time profiles for VPCB in the Chinese cold supply chain, together with microbiological, sensory and biochemical data. Total volatile basic nitrogen (TVB-N), an objective marker of meat quality recognised by Chinese authorities, was also measured. Extensive biochemical testing was conducted on the CSIRO samples including changes in volatile profiles, fatty acid content and non-volatile metabolites. The shelf-life of VPCB was predicted using the University of Tasmania (UTas) prediction model, which uses the initial bacterial counts and the temperature trajectory as data inputs.

#### **Project Outcome**

In general, the cold supply chain in Australia and China was shown to be able to maintain appropriate temperature control (-1°C) to support an extended shelf-life VPCB product up to 140-days. Despite some deviation from the ideal storage temperature of VPCB at the Shanghai International Port, to more than 3-4°C for an extended period, there were no sensory changes indicative of spoilage. The University of Tasmania shelf-life model predicted that nearly all of the Chinese VPCB samples would attain a shelf-life of 120-days and most 140-days. Total volatile basic nitrogen (TVB-N) a meat freshness parameter recognised by Chinese authorities, was measured on all samples. Most of the Chinese VPCB samples had a TVB-N level slightly higher than the threshold of 15 mg/100 g, however there was little indication of organoleptic degradation or spoilage. The data in this study supports the recommendation of other research groups that a TVB-N limit of 20 mg/100 g would be a more appropriate for beef. Increases in free amino acids and carnosine in VPCB samples over time indicated continued proteolysis, which may positively impact on sensory attributes, such as tenderness and flavour intensity. Changes in the volatile profiles of VPCB were not indicative of spoilage. A sharp increase in the concentration of ethanol between 120 and 140-days indicated that this volatile may be a useful indicator of extended shelf-life.

#### **Benefit for Industry**

Overall, the data supported justification for extension of shelf-life limits for Australian VPCB to 140-days, with the caveat that extremely good temperature control needs to be maintained throughout the entire cold supply chain. On the basis of this study, changes in the official Chinese TVB-N limit for beef may be achieved. New objective chemical markers were identified that may be useful in predicting the shelf-life of VPCB.

