Project Summary

Improved tenderness of alpaca carcases using combined processing techniques

Objectives

The research aims to determine guidelines for the processing of alpaca carcases in Australia, to deliver a more consistent eating experience to the consumer and to further enhance alpaca meat quality. The key objectives were to determine:

1. The impact of transportation, lairage and season on meat quality
2. The effects of combining carcase processing techniques (electrical stimulation and tenderstretching) on alpaca meat tenderness
3. The effect of post boning tenderisation by means of protease infusion of alpaca meat products
4. Whole carcase application of processing techniques and product tenderisation to develop industry standards for carcase processing.

Background

Rapid growth within the Australian alpaca industry has increased interest in alpaca meat as a viable alternative to traditional fibre production. This has driven research into alpaca meat eating quality as a means to deliver a consistently high quality product to market. Recent studies have focused on post slaughter components such as carcase and muscle composition, salable meat yield, suitable processing techniques and product ageing. Such research has been fundamental in establishing a framework for the development of a competitive alpaca meat market. This research also highlighted knowledge gaps in the areas of seasonality, transport and lairage stress and combined processing treatment effects on alpaca meat quality. In order to maximise quality and efficiency throughout the alpaca meat supply chain, this research was conducted to address the knowledge gaps.

Research

Three separate studies were conducted across three consecutive years. The first study observed a total of 160 castrated male huacaya alpacas (23 ± 1 month of age) transported to slaughter over a 12 month period. Animals were transported in two (2) groups of 20 per season to generate 8 replicate trials across the year (2017). Live weight, body condition score and pasture samples were collected on-farm, prior to each

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transportation day. Alpacas were transported via a stock truck 4 hours to an abattoir via an identical route for each of the 8 replicate trips. Animals were monitored for the duration of the journey using 8 GoPro cameras (GoPro Hero4 Black, GoPro, San Mateo, California, US) mounted on the corner of each pen within the truck. Footage was later analysed to validate alpaca behaviour during transportation and report variations in agonistic behaviours relating to stress. Immediately following transport, animals were allocated to one of two treatment groups at the abattoir (overnight lairage pre slaughter or seven day rest period with access to feed pre slaughter). Animals were processed under commercial conditions and chilled for 24 h prior to the removal of the rack section of loins (Longissimus thoracis; LT) from the right hand side of each carcase. Meat quality analysis included fresh colour, glycogen, ultimate pH, drip loss, shear force, purge, cooking loss, intramuscular fat and fatty acid analysis.

The second study involved the processing of 36 castrated male huacaya alpacas (23 ± 1 month of age) over two days, two months apart. Carcases were split in half down the vertebral column prior to treatment application and treatments applied to sides at randome, in a 2×2 factorial arrangement. Treatments included (1) No Electrical Stimulation + Achilles Hung (control); (2) Electrical Stimulation + Achilles Hung; (3) No Electrical Stimulation + Tenderstretch; and (4) Electrical Stimulation + Tenderstretch. After 24 hours chilling, carcase sides were broken down and the longissimus thoracic et lumborum (LTL), Adductor femoris (AF), Semimembranosus (SM), Semitendinosus (ST) and Psoas major (TL) muscles were extracted for meat quality evaluation. Meat quality analysis focused on the same traits analysed for study one. In addition retail colour, sarcomere length, lipid oxidation and sensory evaluation were conducted.

The third study involved 36 entire male huacaya alpacas (23 ± 1 month of age) processed over two days, two weeks apart. Carcases were randomly allocated to one of two processing treatments; (1) Achilles hung + No Electrical Stimulation, and (2) Tenderstretch + Electrical Stimulation, in order to investigate the effect of combined processing methods on whole alpaca carcases. Carcases were processed under normal commercial conditions and remained whole for the duration of chilling. After 24 h, carcases were broken down with both the left and right hand side LTL (loin) of each carcase allocated to one of three infusion treatments, including:

1. No infusion
2. Infusion with water
3. Infusion with enzyme.

The allocation was constrained to ensure equal representation of carcase processing treatments across the three infusion groups. In addition to loins, the SM (topside) from the right hind leg of each carcase was collected for meat quality evaluation. Meat quality analyses aligned with those performed in experiment one and two, following the same procedures.

Outcomes

As product moves through the supply chain, from paddock to the consumer, the research determined a number of key outcomes. Product quality was reduced when animals were processed during periods of limited on farm feed availability. As a result, it was concluded that during those periods when pasture availability is limiting, animals should be adequately supplemented or held back from slaughter until they have had access to ample high quality feed for at least four weeks leading up to slaughter.

Through transportation research, alpaca behaviour was successfully quantified, with the identification of variables linked with increased agonistic behaviours. Such variables included time spent sitting and points at which the vehicle stopped. In addition, the observation of potential increased aggression with increased fleece length was noted. The results of this research will significantly contribute toward any future research focussing on alpaca behaviour. The need for further research into the effects of stock crate flooring and the associated impact on animal standing and sitting behaviour was identified.

When focusing on lairage treatments, the research concluded there was no advantage to resting alpacas for seven days prior to slaughter after four hours of transport. As a result of the novel stressors arising from the location change and interaction with other species during rest at the abattoir, muscle glycogen reserves were reduced. This led to decreased quality of the product arising from rested animals. Higher product quality is achieved when sending alpacas direct to slaughter (with an overnight lairage period) after four hours transport.

As a result of both study two and three, there is now ample evidence to indicate the overall positive effects

of medium voltage electrical stimulation combined with tenderstretching on multiple muscles within whole alpaca carcases. Therefore, the research concluded that the post slaughter processing techniques of medium voltage electrical stimulation and tenderstretching should be applied in combination to alpaca carcases as a standard processing procedure.

In addition to the main outcomes of this project, there were additional noteworthy findings. It is evident that alpaca undergoes limited oxidation (both colour and lipid), comparative to other red meat species, during retail display. This provides a unique advantage to industry if moving toward the supply of retail fresh product to consumers. In addition, there is a need for research focusing on consumer acceptability thresholds for unique alpaca colour parameters in fresh meat. This research will be fundamental to informing industry of consumer purchasing decisions for alpaca meat, especially if alpaca enters into the fresh retail market.

Implications

Producers now have additional information which will assist in the decision making process when preparing animals for transportation and slaughter. In addition, they are provided with a greater understanding of how on farm factors and seasonality affect product quality. Processors are provided with a clear outline of best practice carcase processing methods. Industry now has additional information relating to alpaca meat advantages comparative to other red meats and directions for future research.

Publications

Peer Reviewed Journal Articles

Biffin, T., Smith, M., Bush, R., Collins, D., & Hopkins, D. (2018). The effect of combining tenderstretching and electrical stimulation on alpaca (Vicugna pacos) meat tenderness and eating quality. Meat Science, 145, 127–136. https://doi.org/10.1016/j.meatsci.2018.06.002

Logan, B., Bush, R., Biffin, T., Hopkins, D., & Smith, M. (2019). Measurement of drip loss in alpaca (Vicugna pacos) meat using different techniques and sample weights. Meat Science, 151, 1–3. https://doi.org/10.1016/j.meatsci.2018.12.012

Smith, M., Nelson, C., Biffin, T., Bush, R., Hall, E., & Hopkins, D. (2019). Vitamin E concentration in alpaca meat and its impact on oxidative traits during retail display. Meat Science, 151, 18–23. https://doi.org/10.1016/j.meatsci.2019.01.004

Conference Papers

Biffin, T., Smith, M., Bush, R., & Hopkins, D. (2017). The effect of tenderstretching and electrical stimulation on alpaca (Vicugna pacos) meat tenderness. In Proceedings 63rd International Congress of Meat Science and Technology (pp. 295-296), 13-18 August 2017, Cork, Ireland.

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Biffin, T., Smith, M., Bush, R., & Hopkins, D. (2018). The effect of season and post-transport rest on alpaca (Vicugna pacos) meat glycogen content and ultimate pH values. In Proceedings 64th International Congress of Meat Science and Technology, 12-17 August 2018, Melbourne, Australia. http://icomst-proceedings.helsinki.fi/papers/2018_10_10.pdf

Smith, M., Nelson, C., Biffin, Hall, E., T., Bush, R., & Hopkins, D. (2018). Vitamin E concentration in alpaca meat and its impact on oxidative traits during retail display. In Proceedings 64th International Congress of Meat Science and Technology, 12-17 August 2018, Melbourne, Australia. http://icomst-proceedings.helsinki.fi/papers/2018_04_02.pdf

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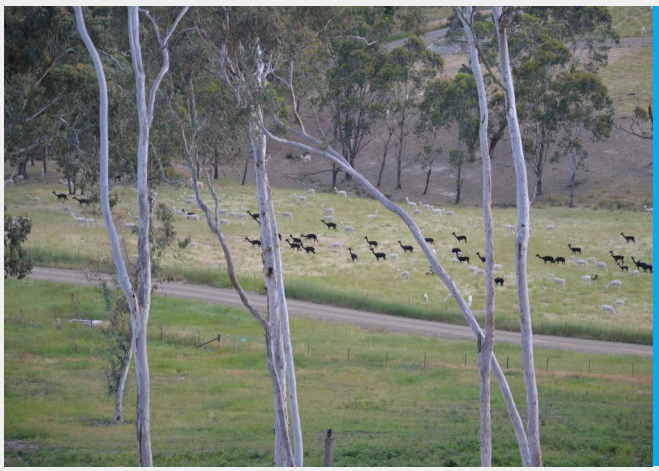

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