Chilling and electrical stimulation of beef carcasses

Effects of chilling and electrical stimulation on carcass and meat quality attributes of selected breeds of cattle with different carcass weights

Industry Sector: Cattle And Small Stock

Research Focus Area: Animal Products, Quality And Value-Adding

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**The Research Team**

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**Aims Of The Project**

- To compile a comprehensive literature review on current chilling and electrical stimulation guidelines
- To compare chilling and electrical stimulation of selected cattle breeds of different carcass weights and to evaluate the effects of different chilling regimes and different stimulation procedures on carcass and meat quality attributes
- To make recommendations to the meat industry on acceptable ways of chilling and stimulating carcasses in order to obtain the best quality carcasses and meat
Industry Research


Scientific Publications (ISI, Peer Reviewed)


OUTCOMES

Abattoirs in South Africa have been focusing on improving carcass yield and quality. Optimum carcass yield and quality are achieved by providing calves with adequate nutrition before slaughter. Carcass yield is influenced by the following factors: feed intake, feed quality, and management practices. The use of growth promoters has been effective in increasing carcass yield. However, their use is limited by the potential negative impact on feed intake and feed efficiency.

The literature suggests that low voltage electrical stimulation (LVES) is an effective method to improve carcass yield and quality. LVES is a process where a low voltage electrical current is applied to the carcass to stimulate muscle and connective tissue growth. The effects of LVES on carcass yield and quality are still under investigation.

The research focused on acceptable ways of stimulating and electrically stimulating carcass yield and quality is ongoing. The impact of LVES on carcass yield and quality is currently under investigation.
Popular Article

Interactions between early and delayed electrical stimulation and carcass size on pH, temperature decline and instrumental shear force of meat samples from Zilmax treated cattle

Introduction
The time of application and duration of electrical stimulation (ES) on light and heavy carcasses from Zilmax treated animals, poses new challenges in the meat processing industry in South Africa. Owing to the use of Zilmax, larger carcasses are now being processed at abattoirs that were built to accommodate smaller carcasses. This poses new challenges in terms of optimization of conversion of muscle to meat using ES and appropriate chilling regime. In this study, the effects of early or delayed low voltage electrical stimulation (LVES) (110V) applied to light and heavy carcasses of Zilmax treated cattle were evaluated for pH and temperature decline, and the resultant effects on instrumental shear force. One hundred and forty-nine Zilmax treated cattle (mainly steers) were assigned to 10 different treatment groups according to the combination of their carcass weight (≤ 130 or ≥ 145kg side), time of stimulation (early stimulation-3 min post mortem [p.m.] or late stimulation-45 min p.m.), and the duration of stimulation (30 or 60 sec). Analysis revealed significantly (p < 0.05) faster pH decline and the lowest pH in carcasses stimulated before evisceration, at all times of measurement compared to carcasses stimulated late or non-stimulated controls. The time of ES application exerted the greatest influence on the pH profile while duration of stimulation showed minor influence. Heavy carcasses in the early stimulated groups had the lowest rigor- and ultimate pH. Regarding temperature decline, heavy carcasses had the slowest decline (p < 0.05) and the highest carcass temperatures at all times from 45 min to 24 hr p.m. Time of ES application and duration of ES did not affect carcass temperature. In terms of shear force, carcasses stimulated at 3 min p.m. had the lowest (p < 0.05) shear force at 3 and 14 days p.m. compared to carcasses stimulated at 45 min p.m. and controls respectively. Heavy carcass groups, stimulated early, with the lowest rigor and pH, had the lowest shear force at 3 and 14 days p.m.

Effects of electrical stimulation and chilling on beef quality

Results of our recent study indicates that the time of application of electrical stimulation has an important influence on carcass pH and temperature profile, and in combination with carcass weight, has a large influence on the tenderness of beef. LVES provides a practical way to manipulate glycolysis in order to improve beef tenderness, but it appears that this treatment should be applied early post mortem in order to be efficient. Although there has been some suggestions to apply LVES later, the present results show that early post mortem application of LVES produced the lowest shear force, mainly due faster pH decline in combination with high initial carcass temperature.

Previous research suggested that at high muscle temperature combined with low pH, heat shortening may occur, leading to lower beef tenderness. Our results indicate that LVES treatment early post mortem passed through the heat shortening window (above 35°C) within 2 hr p.m. when the pH was less than 6. This finding clearly demonstrates that the proteolytic activity was not exhausted by the low pH and elevated initial temperature in the early stimulated carcasses.

Carcass weight also played a part in improving tenderness in the early stimulated carcasses. In addition, Zilmax is known to reduce tenderness in meat but the application of ES could improve tenderness by the early activation of the calpain system. It is important to note that ES-treatment improve but do not completely overcome the negative effects of Zilmax on tenderness. In this study, we found that the combination of early ES and carcass weight significantly lowered the shear force in the heavy carcass groups. Research by Webb and Morris on Zilmax treated cattle also show that heavier carcasses from zilmax treated cattle produced more tender meat.
Please contact the Primary Researcher if you need a copy of the comprehensive report of this project – Prof Edward

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