Has high rigor temperature become a problem in South African abattoirs?

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Introduction: Many physiological factors affect meat quality and in particular meat tenderness. These can occur both pre- and post-slaughter and need to be taken into consideration when studying meat tenderness and other quality attributes. One such factor occurs during the conversion of muscle to meat. Thompson (2002) found that there is an optimum temperature to pH ratio needed during the conversion of muscle to meat to ensure good meat quality, namely a pH of more than 6.0 at temperatures above 35°C and a pH below 6.0 for temperatures below 12°C. High temperatures at rigor mortis can be caused by a rapid pH decline and/or slow chilling which leads to denaturation of the proteolytic enzymes as well as other proteins involved in colour and water holding abilities (Offer et al., 1991). This early exhaustion of proteolytic enzymes leads to impairment of aging and tenderisation. Over the past few years, many changes have happened concerning the production of beef in South Africa which could influence the rigor pathways of beef. These include the move from extensive beef production to intensive production, the wide use of beta-adrenergic agonists, the use of electrical stimulation in abattoirs and an increase in carcass weight (on average 30% since the early 1990s).

Materials and methods: Twelve major abattoirs were visited across South Africa. pH and temperature measurements were taken on 2160 carcasses at 1 hour and 2 hours post-mortem (90 carcasses per day over two days, n=180 per abattoir). Carcass data was collected namely, carcass weight, age-class, and fat code. The data was collected between January 2019 and April 2021. Carcass specification (carcass weight, fat code, age class), electrical stimulation procedures (voltage: high or low; duration, mechanism: rubbing bar, clamps), use of beta-adrenergic agonists, grain vs grass fed as well as chiller specs (temperature and capacity) were all included and considered. pH and temperature measurements were taken in the loin muscle of the left side of the carcass at the 10th rib. pH and temperature measurements were taken at one hour and two hours post-mortem. The second reading was taken to coincide with a drop in pH of below 6.

Results: Rigor occurred at high temperatures (pH < 6 at temperatures above 35°C) for 65.6% of all carcasses, meaning that two thirds of all carcasses went into rigor at high temperatures. Only 24.5% of carcasses went into rigor at temperatures below 35°C while the remaining 9% of carcasses were at risk of going into rigor at high temperatures. The variable, which had the highest effect on the occurrence of high rigor temperature, was carcass weight. Carcass weight affects the frequency of rigor at high temperatures with an increase in carcass weight leading to an increase in the occurrence of rigor at high temperatures. Carcasses, which went into rigor at high temperature, had an average weight of 283kg, while those that were at risk of going into rigor at high temperature had an average weight of 251kg. The group which did not go into rigor at high temperature had an average weight of 242kg. It can therefore be said, that in general, carcasses over 250kg are likely to go into rigor at high temperatures.

Conclusion: In order to reduce the occurrence of high rigor temperature, and the negative effect it has on meat quality, abattoirs need to upgrade chilling systems to better accommodate the larger and therefore heavier carcasses of today's beef production.

Acknowledgements and Financial support statement: Red Meat Research and Development - South Africa for funding of project

Literature:

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