AN EVALUATION OF THE TENDERISING EFFECT OF NEEDLE-INJECTING HOT, PRE-RIGOR LAMB CARCASSES WITH A FICIN-WATER SOLUTION

Erik Baumann and Karim Farag*

Department of Food Science and Agri-Food Supply Chain Management, Harper Adams University Newport, United Kingdom.

*Corresponding author email: kfarag@harper-adams.ac.uk

Abstract –Among the vegetable based proteolytic enzymes, ficin is generally regarded as one of the least effective tenderiser when compared to papain and bromelain yet some studies disagree. This work is thus aiming to test a procedure to potentially enhance the tenderisation effect of ficin by injecting it into hot, pre-rigor lamb carcasses on the premise that the residual carcass heat will improve the effect. Hot carcasses were needle injected with 105% of ficin-water solution and the *longissimus dorsi (LD)* and the *semimembranosus* (SM) excised, subjected to a sensory and Warner-Bratzel shear force evaluation and compared to a control and a post-rigor treated group. The pre-rigor method was then judged according to its effectiveness and commercial benefit.

Key Words – GRAS Enzymes, Proteolytic Enzymes, meat conditioning.

I. INTRODUCTION

This paper investigates the tenderising effect of ficin (EC 3.4.22.3) on lamb carcasses and its varying strength relative to the carcass temperature. The authors hypothesize that ficin yields a more significant tenderization effect in hot, pre-rigor treated lamb carcasses than in cold, post-rigor carasses because of ficin's ability to degrade elastin at temperatures above 20˚C (El-Garbawi and Whitaker, 1963). Although out of the five exogenous enzymes that are Generally Recognised As Safe (GRAS), ficin is not the most popular tenderizer commercially, its lower inactivation temperature (>70˚C) compared to bromelain and papain (>80˚C) makes the tenderisation more controllable and hence significantly reduces the risk of the over-tenderisation.

II. MATERIALS AND METHODS

For this study 12 near identical lamb carcasses were randomly assigned to three groups, one untreated control group, and two groups that were injected with 105% of green weight with a water and enzyme solution into the *longissimus dorsi (LD)* and the *semimembranosus* (SM) immediately after dressing and post-rigor mortis respectively. As shown in figure 1, a triangular sensory evaluation using the SM was scheduled after 6 days for a subjective evaluation of tenderness and for the *longissimus dorsi (LD)* the following tests were carried out: Warner-Bratzler shear force tests (0h, 12h, 24h, 48h, 72h and 6d after packing) to map the development of tenderness over time objectively, colour, drip loss and Total Viable Count (TVC) aided the evaluation of the commerciality of ficin in lamb meat production.

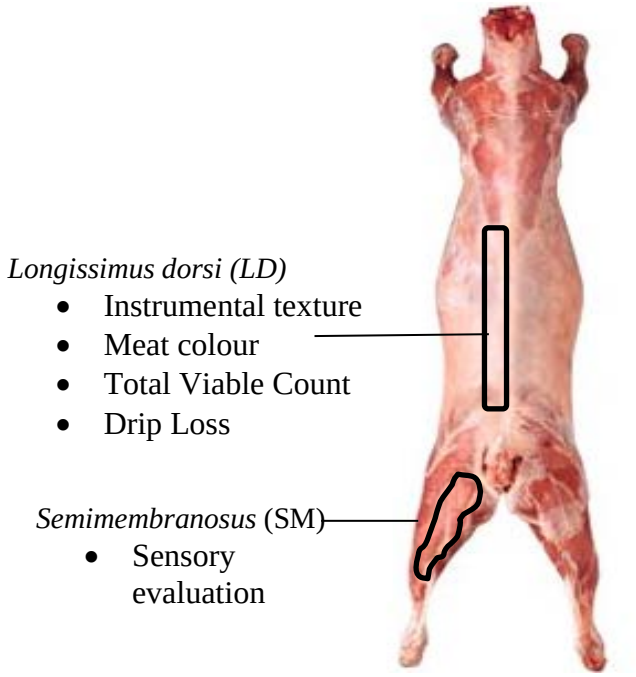

Figure 1: Lamb Carcass indicating location of tests carried

III. RESULTS AND DISCUSSION

Papain in particular can occasionally papain result in over-tenderisation (Calkins and Sullivan 2007; Han, Morton, Bekhit and Sedcole, 2009; Tarté, 2014) which is problematic in high-value meat cuts such as lamb loins (LD). On the other hand, the pressure to reduce fat in the industry with its subsequent ramification on tenderness, especially for lamb increase the likelihood of the commercial use of tenderisers in the future. If the results confirm ficin to be indeed competitive to other enzymatic tenderisers in its effectiveness, it can be a viable alternative for high-value cuts that are prone to over-tenderisation. However, ficin is significantly more expensive and unsteady in supply compared to papain and bromelain so the tenderisation effect has to be judged relative to these disadvantages.

IV. CONCLUSION

Whereas the study is still in its early stages, the authors hope to see a significant increase in tenderness of the pre-rigor injected meat which could potentially justify the more-widespread commercial use of ficin.

ACKNOWLEDGEMENTS

The authors thank the Baumann company in Germany, a leading processor of lamb meat in the country, for its assistance and provision of its facilities for this study.

REFERENCES

1. El-Ghbarwi, M.&Whitaker, J.R. (1963) ‘Factors affecting enzymatic solubilization of beef proteins’, *Journal of Food Science*, 28(2), pp. 168–172.

2. Calkins, C., Sullivan, G. and Sullivan, P. (2015) Adding Enzymes to Improve Beef Tenderness. Available from: beefresearch.org

3. Han, J., Morton, J.D., Bekhit, A.E.D. and Sedcole, J.R. (2009) ‘Pre-rigor infusion with kiwifruit juice improves lamb tenderness’, *Meat Science*, 82(3), pp. 324–330.

4. Tarté, R. (2014) *Ingredients in meat products: Properties, Functionality and applications*. New York: Springerverlag New York.