

EFFECT OF TUMBLING AND ANTIOXIDANT MARINATING ON THE TENDERNESS AND NUTRITIONAL QUALITIES OF INTERMEDIATE TENDERNESS BEEF CUTS FROM GRASS-FED CROSSBREDS

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I. INTRODUCTION

Meat tenderness is a very important quality trait that determines consumer acceptance, repeat purchase and willingness to pay higher prices [1]. This multifactorial quality trait is difficult to control. Several post-mortem tenderization techniques have been developed to improve meat tenderness. Tumbling, a mechanical *post-mortem* tenderization technique, involves placing meat pieces in cylindrical drums subjected to rotation. This method is widely used in the manufacture of cooked ham and promotes the diffusion and absorption of marinades within the muscular tissue [2]. Since the beginning of the 21st century, there has been an increasing interest in the use of natural antioxidants to preserve meat products and enhance their nutritional qualities [3]. The aim of this study was to investigate the combined effect of tumbling and antioxidant marinating processes on the tenderness and nutritional qualities of beef cuts from young grass-fed cattle.

II. MATERIALS AND METHODS

The meat cuts used in this study were obtained from 16 *Semitendinosus* (ST) muscles removed from both sides of eight young Angus x Salers crossbred cattle aged 16 ± 1 months. These cattle were raised at INRAE's experimental plant and fed on a 65% grass diet. The muscles were cut to obtain 24 cm long and 6.5 cm diameter meat pieces. Two 3 cm-thick slices were taken from each end of the meat pieces and were used as control meat pieces (CT). The remaining 18 cm long meat pieces were used to be either tumbled (T) or marinated (TM) in a cold room at 4 °C using a laboratory tumbling simulator developed by Daudin *et al.* [2]. The marinade consisted of a mixture of water and grape seed and olive extract in a v/v proportion of 99.6% and w/v proportion of 0.4%, respectively. After application of the different processes, the meat pieces were used either as raw (R) or cooked under vacuum in a water bath at 60 °C for 1 hour (C). The tenderness of the raw and cooked meat pieces was evaluated by measuring the shear forces (SF) with a shear cell developed by Salé [4]. Weight loss was determined by measuring the difference in weight before and after the process and cooking. The nutritional quality of the meat pieces was investigated by determining the fatty acid profile. Linear mixed models in « R » (R version 4.1.1.) were used to analyse the data and determine the effect of cooking and processes on tenderness, weight losses and fatty acid profile.

III. RESULTS AND DISCUSSION

The tumbled (T) and tumbled-marinated (TM) meat slices, whether raw (R) or cooked (C), demonstrated significantly ($P < 0.05$) lower shear force (SF) values than the control (CT) meat slices (Figure 1A). These observations are consistent with the findings of N'Gatta *et al.* [5]. The raw TM meat

pieces were tougher than T meat pieces, but this difference was imperceptible when they were cooked. There were no differences in weight loss observed between the raw meat pieces, while the cooked T meat pieces exhibited lower cooking losses compared to CT and TM meat pieces (Figure 1B). Sous vide cooking of meat pieces resulted in an average increase of 36% in fatty acids content, attributed to the concentration induced by juice losses, as demonstrated by Gruffat *et al.* [6]. Additionally, the TM meat pieces had significantly higher level of n-6, n-3, and n-3 long chain polyunsaturated fatty acids (PUFAs) than the CT and T meat pieces, due to the antioxidant molecules and PUFAs provided by grape seed and olive extracts.

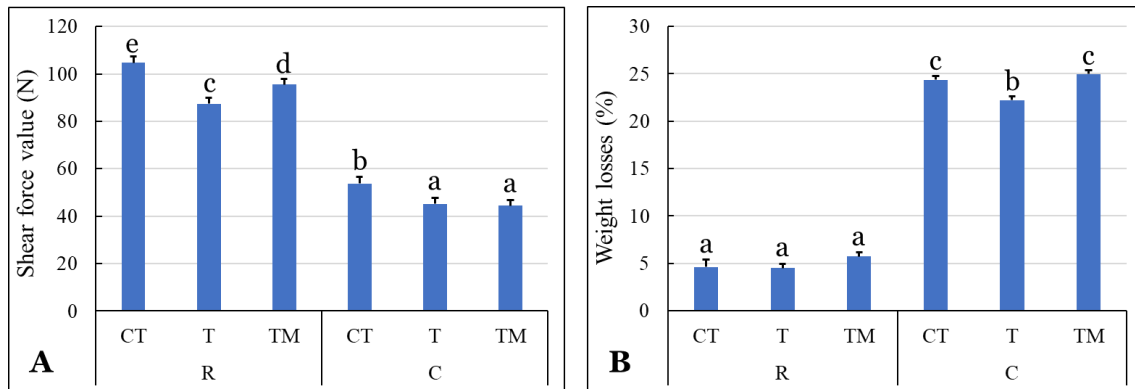


Figure 1. (A) Shear forces values and (B) weight losses of meat pieces from ST muscles of cattle tumbled (T), tumbled-marinated (TM) or not (Control, CT) and then used as raw (R) or sous vide cooked at 60 °C for 1h (C). The data correspond to mean values \pm standard error (SE) calculated from 18 and 3 individual samples per treatments for shear forces and for weight losses, respectively. Different letters (a–d) refer to significant differences between all treatments ($P < 0.05$).

IV. CONCLUSION

Tumbling and antioxidant marinating can be used to better valorize the beef cuts by improving their tenderness and nutritional qualities. However, it would be relevant to conduct sensory studies to evaluate the consumer's interest in these products.

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