Effects of marinated whole or slices of muscles concerning beef palatability

Patissier E. [1], Picgirard L. [1] and Parafita-Thomas E. [1]

[1] ADIV, Process engineering, technology and product quality department, Clermont-Ferrand, France

Abstract— **The aim of this study was to investigate whether marination by injecting on whole muscle or by tumbling slices has an effect on beef palatability. Two beef *Semimembranosus* muscles, aged three days, from the same animal have been used in this study. One of the *Semimembranosus* muscle was injected at 110%; the other muscle was cut into slices and tumbled alternatively with 12% of the same brine. The two muscles were stored under vacuum for 48H at 4°C. They were cooked in the same way. This experiment was repeated twice. Tenderness was evaluated by Warner Bratlzer shear force and cooking yields were calculated. The results show that there is no significant effect on the cooking yields. Nevertheless, there is a really significant difference of tenderness between the two different types of marination ($p<0.01$). Indeed, muscle cut into slices and tumbled was tenderer than whole muscle injected. In terms of tenderness, tumbling slices is more efficient than injected whole muscle. It should be recommended to manufacturers as they will be able to provide meat of higher quality.**

Keywords— **Injection, tumbling, tenderness**

INTRODUCTION

Nowadays, beef tenderness is an important factor which determines the purchase of the consumer and allows securing his loyalty [1]. In 2009, Lapendrie and Parafita have studied the effect of Blade tenderization and injection on *Semitendinosus* beef muscle [2]. They demonstrated that the combination of blade tenderization and injection improve meat tenderness. Some variations can be made concerning injection methods combined with blade tenderization. The aim of this study was to investigate whether blade tenderization following by whole muscle injection or slices tumbling have an impact on *Semimembranosus* beef palatability.

II. MATERIALS AND METHODS

Four *Semimembranosus* muscles from three years old Heifers Charolais have been used in this study. Muscles were purchased 3 days after slaughter and vacuum packaged. The average pH of the meat was 5.49+/- 0.01. In order to avoid the animal variability, two *Semimembranosus* muscles from the same animal were used and the experiment was repeated twice with another animal. Each muscle was mechanically tenderized once per side with a mechanical tenderizer. One of the *Semimembranosus* muscle was injected at 110% with a multi needles injector with a brine solution containing 5.6% of salt, 5% of lactose 4% of sodium lactate, and 0.5% of sodium ascorbate diluted in water. The other muscle was cut into slices 1.5 cm thick and tumbled with 12% of the same brine. The tumbling was alternatively 5 minutes on and 10 minutes off while 3 hours. These two muscles were stored 48 h under vacuum at 4°C before cooking.
After this waiting time, they were cooked in the same way, the whole muscle was cut into slices 1.5 cm thick and slices from both muscles were cooked on a grill while 2 minutes per sides until the meat core temperature reaches 55°C.

Cooking yield was calculated by weight difference before and after cooking for each muscle or slice. Shear force was measured according to the reference methods from Honikel, 1998 with a Warner Bratlzer device[3].

Results were analyzed thanks to an ANOVA test providing a p which gave the significance of the results.

III. RESULTS AND DISCUSSION

Injecting whole muscle or tumbling slices had no significant effect on the cooking yield ($p=0.12$).

Indeed, the cooking yield for injected whole muscle was 83.37% +/- 0.508 and 82.04% +/- 0.665 for tumbled slices. With these results it can be supposed that whole muscle injected at 110% in the core absorb brine as well as the tumbled slices with 12% of brine. Although the results are not significant, they follow the way that injection is more efficient than tumbling to keep the cooking yield as high as possible. In this experiment it seems to be an equal absorption of the brine, this can be explained by the thickness of the slices allowing a good penetration of the brine into slices.

Concerning shear force measurements, the difference between injected whole muscle or tumbled slices is highly significant ($p<0.005$) (figure1).

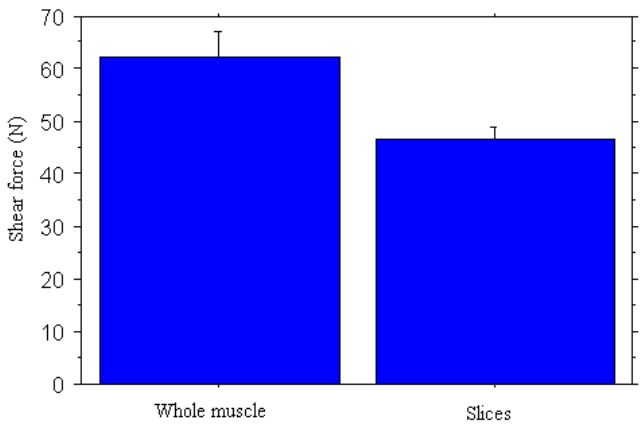

Figure 1 Impact of injected whole muscle or tumbled slices on shear force

Shear force average obtained for tumbled slices alternatively during 3 hours was 46.64N whereas for whole injected muscle it was 62.434N. The tenderness was 25.3% increased for tumbled slices compare to inject whole muscle. Although the animal factor was cancelled by repeated the experiment twice and by statistical calculation, it will be relevant to validate this with a larger number of animals.

The increasing of tenderness for tumbled slices can be due to the fact that the tumbling allowed to damage the muscle fibres already broken with the blade tenderization whereas in the case of injection of whole muscle, the fibres were only broken with the blade tenderization.

III. CONCLUSIONS

Tumbling Beef *Semimembranosus* slices with 12% of brine improve significantly tenderness of 25.3% compared to injected whole muscle. It had no effect on cooking yield. Consequently, this method should be advice to manufacturers which want to give added value to their meat. The tumbling tested in this experiment last 3H, it could be interesting to test shorter tumbling to reduce operating costs at industrial level (energy, investment). However, Pietrasik and Shand (2004) have shown that tumbling beef meat for 16H allows improving cooking yield and decreased shear force value [4]. Manufacturers should find a compromise between cost and time to have tenderer meat. Moreover, colour measurement could be done in order to evaluate the effect of the processes on meat colour. It also could be tested to injected slice with an injector in order to know if there is still an effect on tenderness and if it is better or not.

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