Ageing time effect on meat tenderness of 5 beef muscles provided by steers and dairy cows

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Background

For the consumer tenderness is one of the most important properties of beef meat (Belew, 2003). With the decreasing meat consumption, the beef meat industry has to provide meat products which suit the consumer in terms of tenderness all the more since roast and grilled meat is more and more important for him. The main factors controlling meat tenderness occur after slaughtering (Dransfield, 1994). Among these factors, if the aging time effect on meat tenderness is quite well known, this factor is not used enough in the French beef meat industry. It has already been emphasized by Touraille (1990).

If Bratcher (2005) reported that post-mortem aging affects all muscles he studied *(Triceps lateral head, Triceps long head, Splenius, Complexus, Rhomboideus, Serratus ventralis, Infraspinatus, Vastus lateralis, Rectus femoris)* in similar manner for WBSF values, what about 5 others muscles intended in France to be grilled or roasted?

This is the aim of this work.

Objectives

The main objective of this investigation is to compare the aging speed on meet tenderness of 5 different muscles removed from 2 animal types, steers and dairy cows.

Methods

Forty carcasses were selected on the slaughter line : 20 steers (17 to 24 months old, 268 to 374 kg) and 20 cows (35 to 184 months old, 283 to 334kg). According to the EUROP grading system the carcasses scores were between P=2 and O=3 for steers and P+2 and O-3 for dairy cows. Electrical stimulation was not used. 24 hours after slaughtering 5 muscles from each carcass were removed: *Longissimus dorsis* (LD), *Semimembranosus* (SM), *Rectus femoris* (RF), *Semitendinosus* (ST), *Triceps brachii caput* (TB). All 5 muscles removed from each carcass were cut into 4 parts before vacuum-packaging. One side was frozen 3 days after slaughtering, while the other sides were aged for 5, 7 or 14 additional days at 2°C before freezing (-24°C) for the SM, RF and ST. The periods of aging were longer for LD and TB: 7, 14 and 21 days before freezing.

After defrosting, each muscle was cubed and cooked in an oven at 310°C for 7 minutes, until the internal end-point temperature of approximately 57°C was reached. A selected and trained panel of 12 judges performed the sensory analysis. The samples (3 in each plate) were served to the judges who compared and scored them for tenderness on a scale from 0 (tough) to 100 (tender). From the same carcass and the same muscle each plate contained 3 samples corresponding to 3 aging times out of 4.

Statistical evaluation was performed using the procedure MIXED in SAS.

Results and Discussion

In this experiment the results from sensory evaluation show:

- 3 different shapes of tenderness evolution with aging time:
    - a regular and an unbroken improvement (LD and more slowly for the ST and SM), cf. figures 1,2,3;
    - a slow beginning up to 7 days aging, followed by a real improvement between 7 and 14 days (RF), cf. figure 4;
    - a quite fast beginning up to 7 days, followed by an upper limit between 7 and 21 days (TB), cf. figure 5.
- For a given muscle, the tenderness evolutions with the aging time are the same whatever the animal type, cow or steer. Either they are superposed if the original tenderness (measured at 3 days) levels are the same, or parallel if they are different. Then, for the TB or SM muscle, the meat seems to have the same tenderness level whether it comes from a steer or a cow (cf. figures 6,7). But for LD, the

results show that the cow is more tender than the steer (cf. figure 8). For the RF muscle ($p<0.12$), and for the ST muscle, we have the opposite result: steer meat is more tender than cow meat (cf. figures 9 and 10).

- The tenderness gain (= tenderness at 3 days / tenderness at 14 days X 100) observed during the aging time depends on the muscle. Between 3 and 14 days we find in increasing order BT, RF, ST, SM and the LD with 19%, 20%, 33%, 35% and 40% respectively.
- After 14 days aging, meat tenderness carries on increasing. This is the case for LD, not for TB (cf. figures 1 and 5).

Conclusions

These results could be used in a practical way, to optimise the aging time in order to improve meat tenderness. Recommendations can be given for work shops to optimise the use of aging time:

- The LD muscle could be aged for up to 21 days;
- For the RF, SM or ST muscles more than 7 days or no aging time could be right;
- For the TB muscle, 7 days is enough.

This would indicate that muscles need to be treated on an individual basis during fabrication.

References

Belew J.B., Brooks J.C., McKenna D. R., Savell J. W., 2003 – Warner-Bratzler shear evaluations of 40 bovine muscles. Meat sci. 64, 507-512.

Bratcher C. L., Johnson D. D., Littell R. C., Gwartney B. L., 2005 – The effects of quality grade, aging and location within muscle on Warner-Bratzler shear force in beef muscles of locomotion. Meat Sci. 70, 279-284.

Dransfield E., 1994 - Optimization of tenderisation, aging and tenderness. Meat Sci. 36, 105-121.

Touraille C., Aurier B., Lepetit J., Bayle M.C., 1990 – Maturation de la viande bovine : évaluation par des méthodes mécaniques et sensorielles et par des consommations. VPC, vol 11 Nov – déc, 291-292.

Figures 1 to 5 : meat tenderness growth with aging time, according to different muscles

Figure 1 : LD

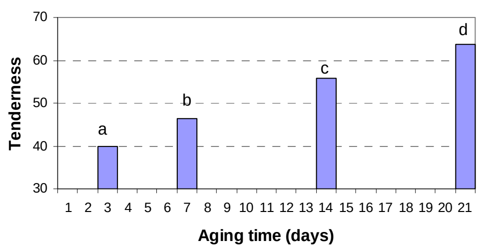


Figure 2 : ST

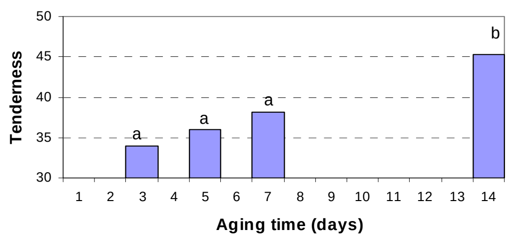


Figure 3 : SM

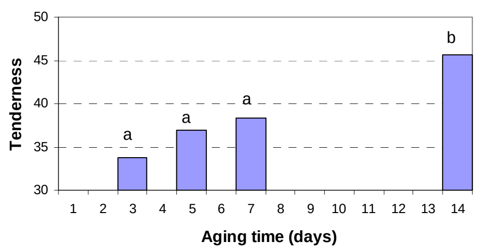


Figure 4 : RF

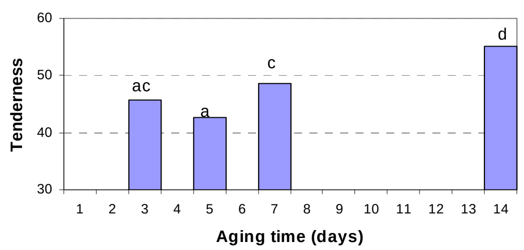
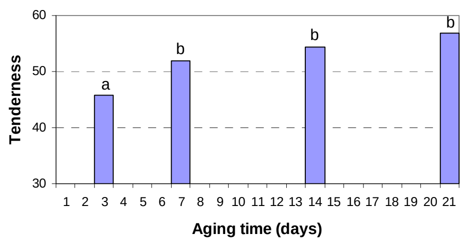


Figure 5 : TB



a, b, c, d for the same muscle, bars with no super script in common differ significantly ($p<0.05$)

Figures 6 to 10 : compared evolution on aging time (ST steer ▲ DC dairy cow - ●)

Figure 6 : TB (NS)

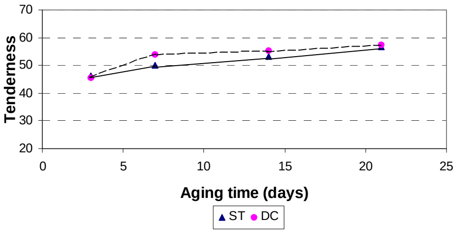


Figure 7 : SM (NS)

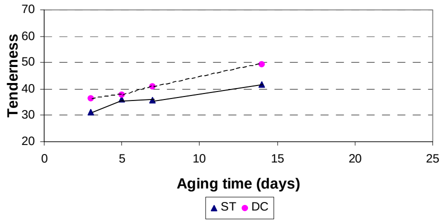


Figure 8 : LD (p<0.05)

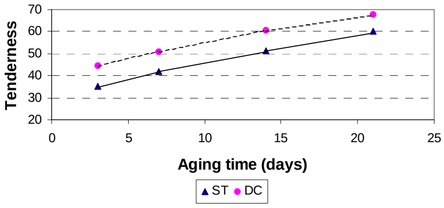


Figure 9 : RF (p<0.12)

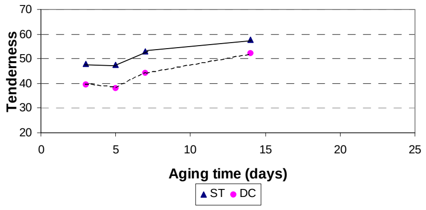
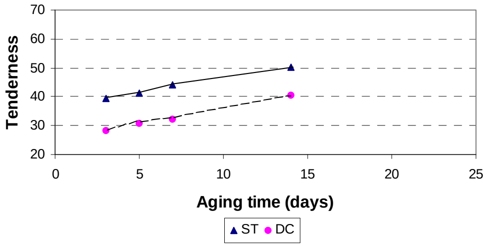


Figure 10 : ST (p<0.004)



NS : non significant