

Effect of tumbling time on raw beef of intermediate initial tenderness

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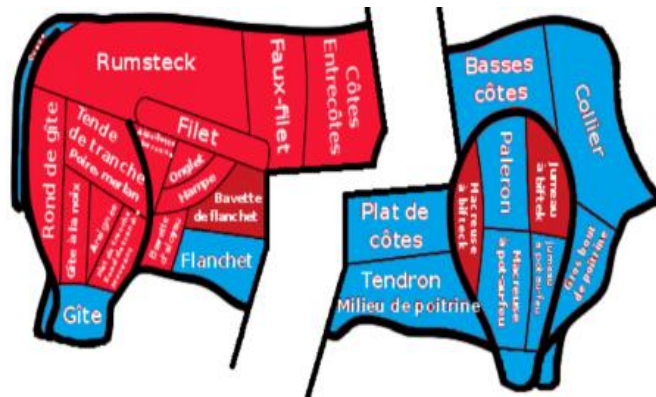
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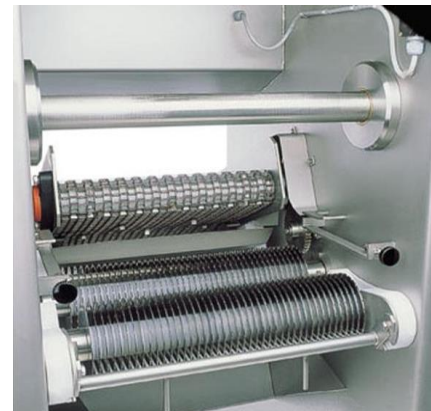
Animal Product Quality Research Unit (UR QuaPA) & Joint Research Unit on Herbivores (UMRH)

➤ Introduction

Background



- Production of minced meat from beef
- Difficulty to valorize some bovine muscles
- Consumer demand for high-quality meat products



> Introduction

Background and objective

- Process used in the manufacture of cured and/or cooked meat products (Daudin et al. 2016)
- Meat structure damaging, increasing brine sorption and protein extraction (Xaragayo et al. 1998).



- Evaluate the effect of tumbling time on raw beef of intermediate initial tenderness by using a laboratory tumbling simulator.

➤ Materials and methods

Mechanical treatments

15 ST muscles from charolais cows (52 months),
matured under-vacuum for 21 days / 4°C



Removal of the two ends



Cutting for obtention of cylindrical meat pieces
(20cm L and 6.5cm ø)



Tumbling with a laboratory tumbling
simulator (Daudin et al. 2016) at a
compression rate of 40%

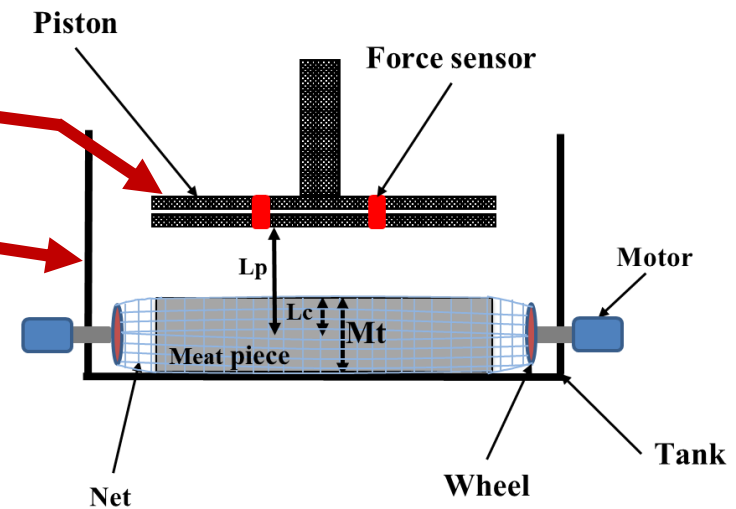
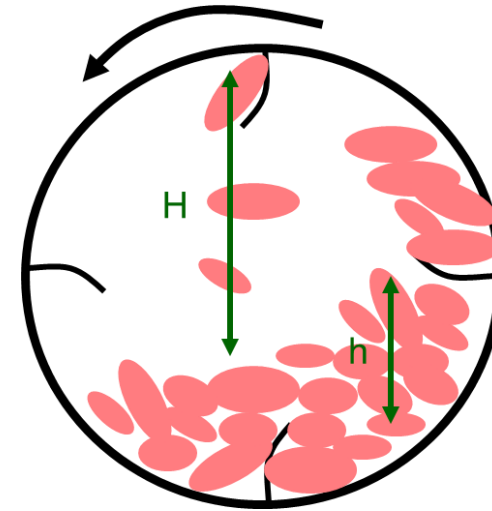
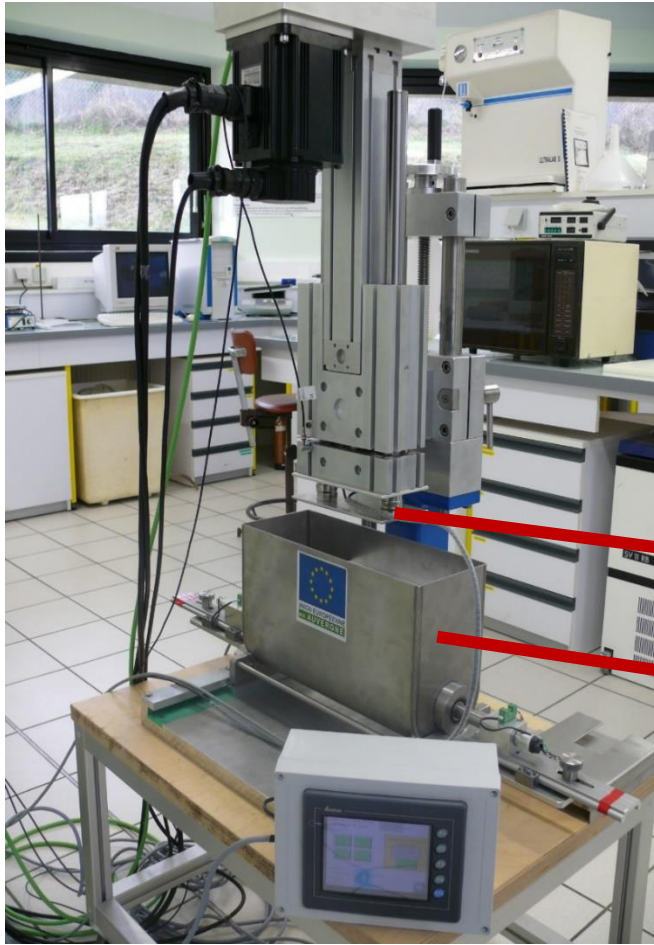


NT : No tumbled (control)
T1 : (3h ; 2500 cycles)
T2 : (7.5h ; 6000 cycles)
T3 : (12h ; 9500 cycles)
T4 : (16h ; 13000 cycles)



➤ Materials and methods

Tumbling simulator (Daudin et al. 2016)



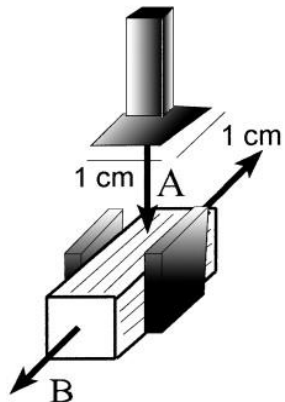
➤ Materials and methods

Sampling, textural measurement and histological studies

S1 – S6: 3cm-thick slices => textural measurements (samples of rectangular cross-section, 1x1x3 cm³)

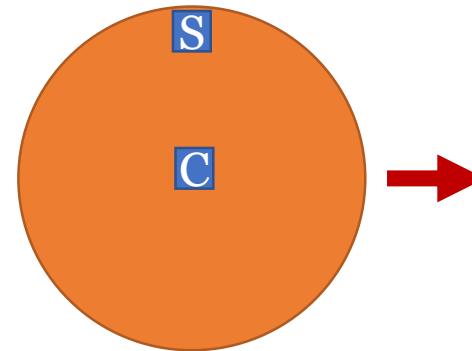
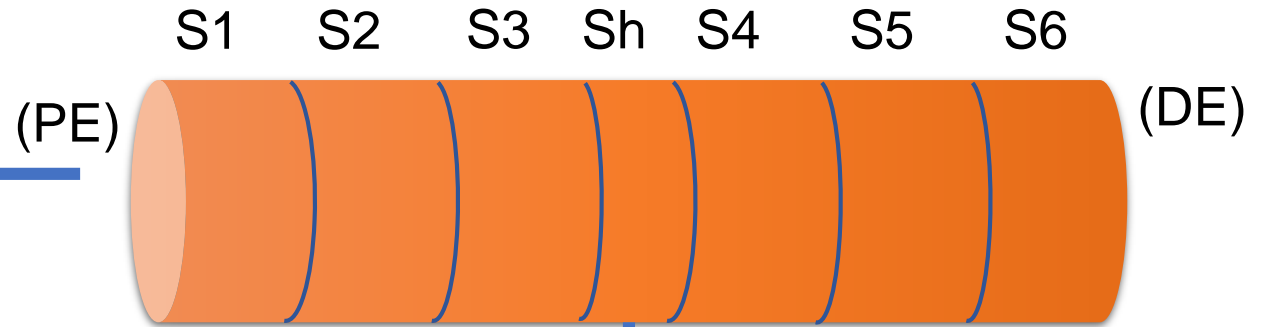
Instron 5543

Compression speed : 50 mm/min



Stress at 20 % of maximum compression

Stress at 80 % of maximum compression



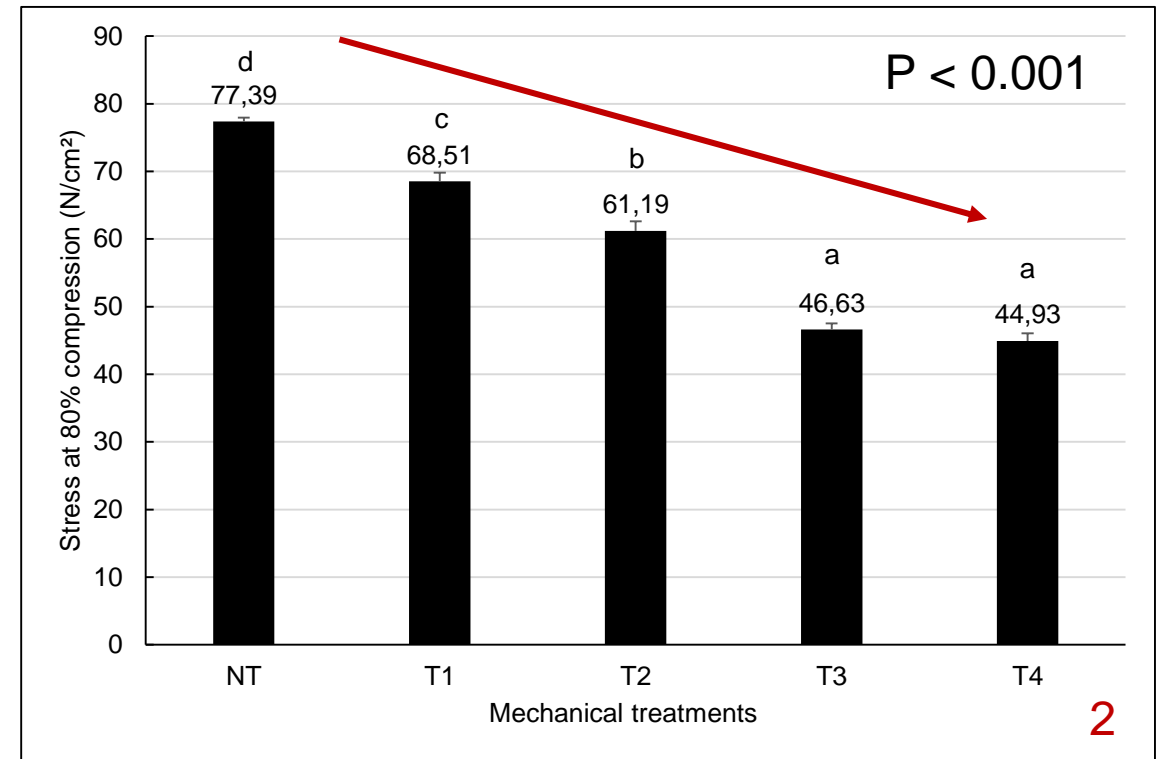
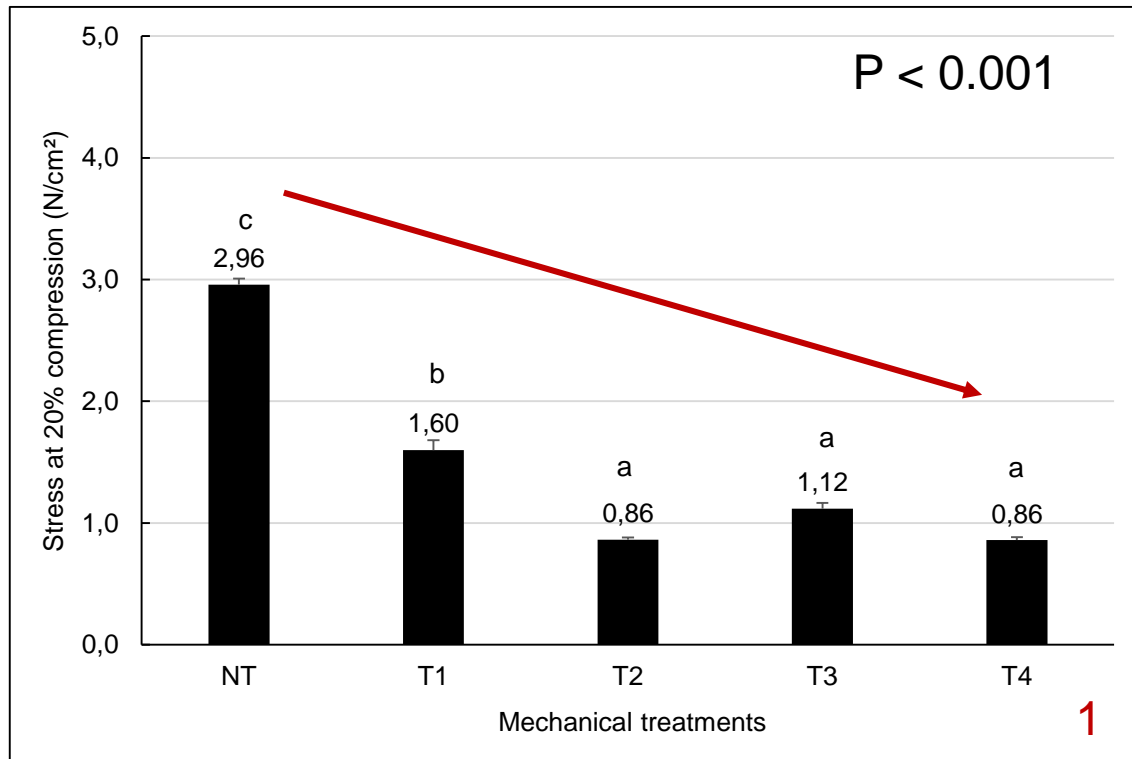
1. Microstructural observations: 1 cm³-samples, 10 μm-thick stained with Hematoxyline Eosine Safran (HES).

2. Ultrastructural observations : 10x3x3 mm³-samples, 90 nm-thick stained with uranyl acetate and lead citrate.

Source : Campo et al. (2000)

➤ Results

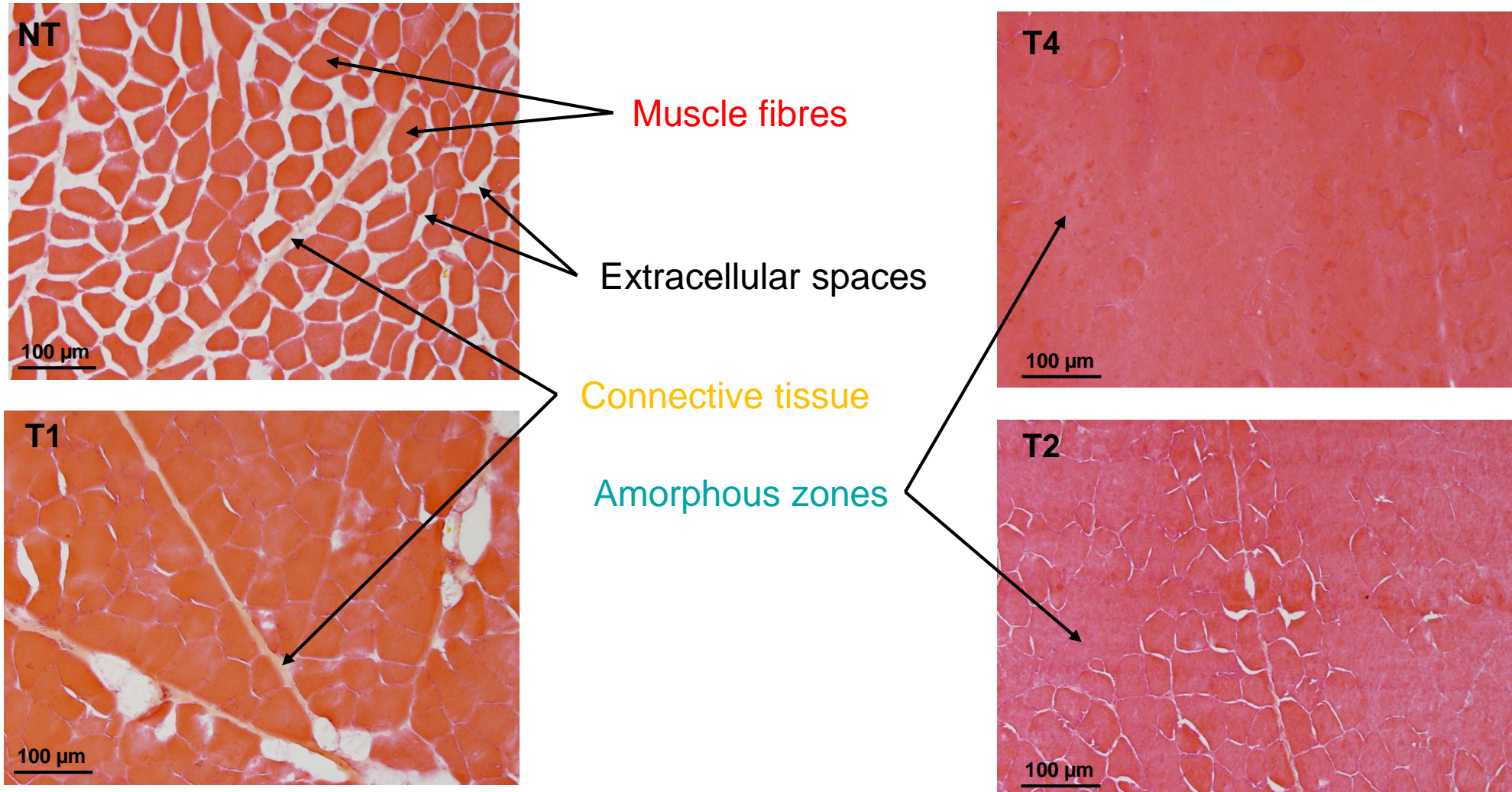
Effect of tumbling time on the mechanical properties



Means values with different letters (a–d) are significantly different ($P < 0.05$) according to the Tukey test

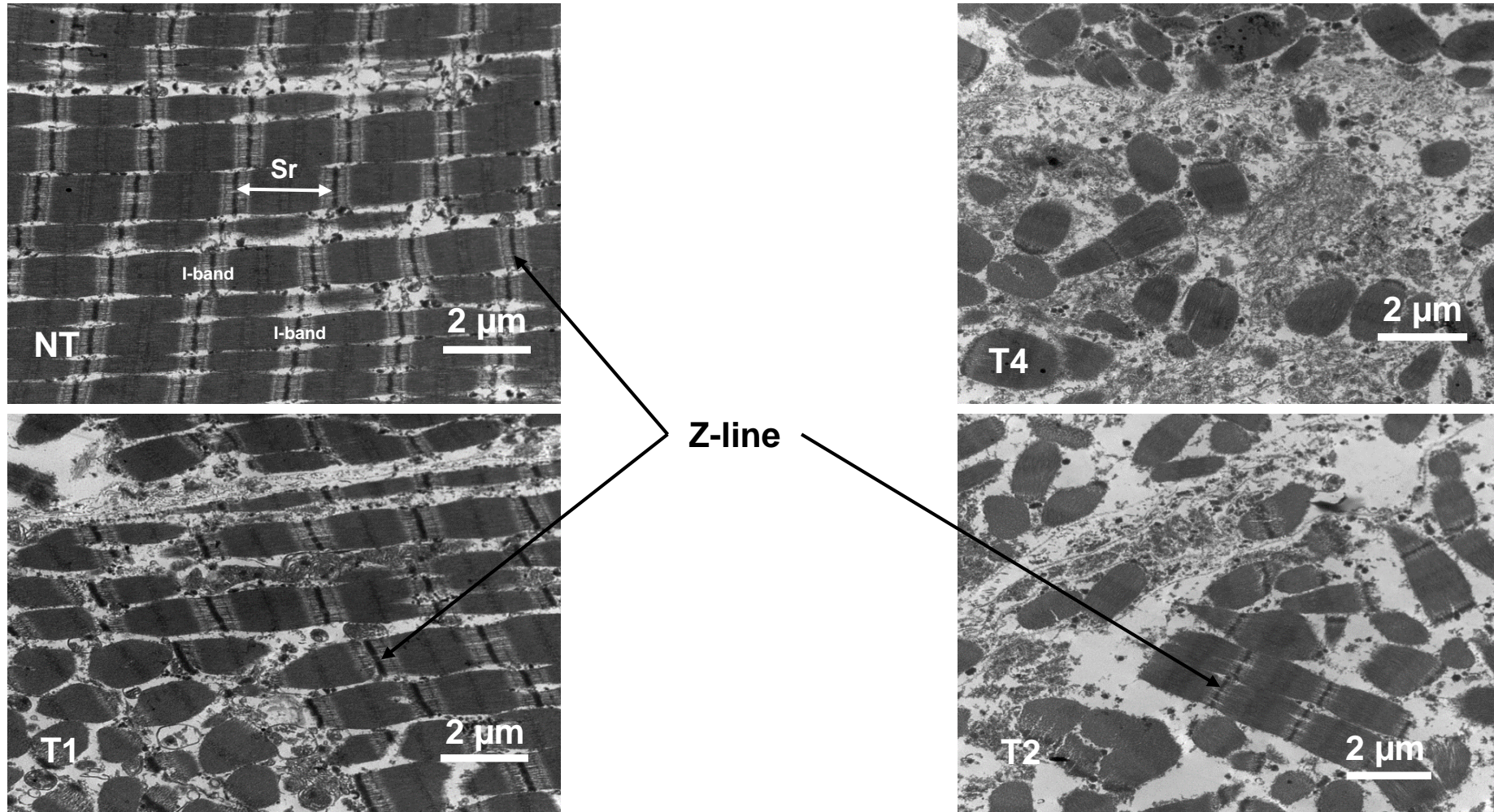
➤ Results

Effect of tumbling time on the meat piece microstructures (level C)

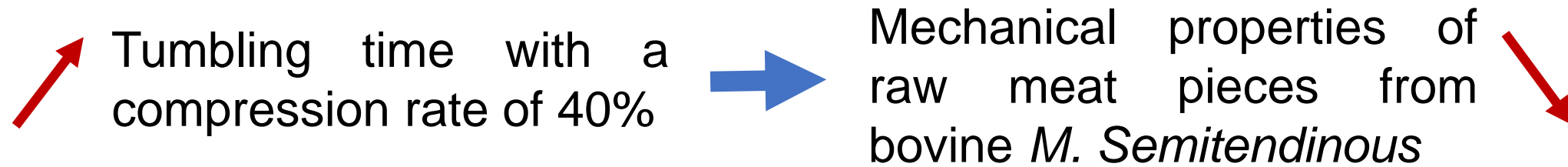


➤ Results

Effect of tumbling time on the ultrastructure changes (level C)



➤ Discussion (1/2)



- Extending tumbling time (to 12h) lead to a reduction in textural parameters and rheological properties of three pork ham: *Biceps femoris*; *Semimembranosus* and *Quadriceps femoris* (Lachowicz et al. 2003).
- Decreasing in mechanical properties of tumbled meat is caused by meat structure disruption and disintegration.

➤ Discussion (2/2)

- Increasing mechanical deformations numbers with a compression rate of 40 %, lead to 1) the reduction of extracellular spaces, 2) the disruption of muscle fibres and connective tissue and 3) the fragmentation of the myofibrils.

- Theno et al. (1978) have shown that increasing tumbling time (to 24h) lead to a massive fibre disruption and a loosing of meat structure integrity.

- Extending tumbling time promotes the alteration of meat piece structure and ultrastructure.

➤ Conclusion

- Extending tumbling time (to 16h) reduces the toughness of muscle fibres and connective tissue of raw beef pieces by 60% and 40%, respectively.
- Mechanical tenderization with a laboratory tumbling simulator promotes the loosening of meat structure by compacting muscle fibres and increasing the fragmentation of myofibrils.



- Evaluation of the effect of these mechanical treatments on meat pieces with different aging times.



THANK YOU FOR YOUR ATTENTION