ASSESSING THE WATER DYNAMIC OF AGED BEEF BY TD-NMR RELAXOMETRY

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I. INTRODUCTION

Eating beef can be considered as a sensorial experience, a moment of mindfulness and mouthfulness, so consumers are increasingly demanding high quality meat, mainly focusing on tender with a distinctive and consistent flavour [1]. In order to attend this increasing demand, meat aging process has been widely used to improve meat quality properties. The wet aging is the most common way to produce aged beef; however, the dry-aged process has gain more attention, due to its capacity to enhance unique beefy, nutty, brown roasted or buttery flavour [2], probably due to flavours compounds concentration. However, due the higher amount of shrink and trim losses for dry samples, some alternatives should be studied, in order to produce meat with flavour near to the dry ones. In that way, the use of moisture absorber with or without mechanical tenderization, could remove part of the intramuscular moisture and improve the meat flavour, by flavour concentration. Therefore, the aim of this study was to evaluate the water drying dynamics of the meat internal part and on the surface of meat aged with different methods using TD-NMR relaxometry.

II. MATERIALS AND METHODS

A total of 24 bone-in loins from Nellore cattle were assessed in four treatments: Wet) meat aged with vacuum package; Dry) meat aged unpackaged; Abs) meat aged into a vacuum package with moisture absorber (M6175S, McAirlaid's, Germany); and Abs+MT) mechanical tenderized meat aged into a vacuum packed with moisture absorber. After 28 days aging, the TD-NMR analyses were performed in a SLK-IF-1399 (0.23 T) spectrometer with a 10 cm probe. The transverse (T_2) and Longitudinal (T_1) relaxation times were measure using the Carr-Purcell-Meiboom-Gill (CPMG) [3] and inversion-recovery (IR) [4] pulse sequences, respectively. For this analyse, 48 steak samples were used: 24 from to the inner part (INT), consisting to the deepest portion of the steak; and 24 from the meat surface (EXT) consisting of the 3 mm of the surface of each steak. The TD-NMR data were analysed using the Inverse Laplace Transform (ILT) as a mathematical procedure [5], to obtain the continuous distribution of T_1 (IR) and T_2 (CPMG) values, also known as relaxation spectra, using an in-house ILT algorithm based on the Tikhonov regularization [6].

III. RESULTS AND DISCUSSION

Our results showed that differences between aging methods are more visible on CPMG (T_2) signals than IR (T_1) signals, so IR data has not been showed. The relaxation distribution (ILT) of the CPMG signals of the INT and EXT are presented in Fig. 1 A and B, respectively. Fig. 1A suggest that inner part of the meat present similarities on water dynamic among treatments. Nonetheless, the differences observed in the surface are more pronounced (Fig. 1B), once the shift and areas of the T_2 peaks are

mainly due the significantly higher moisture losses in dry-aged compared to the others. These data fits well with the total process loss (trimming and evaporative losses), aroung 50% for dry aged meat compared to 10, 12 and 4 % of total loss for AbsTend, Abs and Wet aged, respectivelly. Additionally, it can be observed that the use of absorber, regardless tenderization, promotes a shift and a narrowing of the main peak (~50 ms) to small values compared to Wet treatment, showing that the use of absorber improved the meat surface moisture loss, suggesting that it could be an alternative to produce meat with properties on between wet and dry-aged meat. Statistically the differences between Abs and AbsTend process were not expressive.

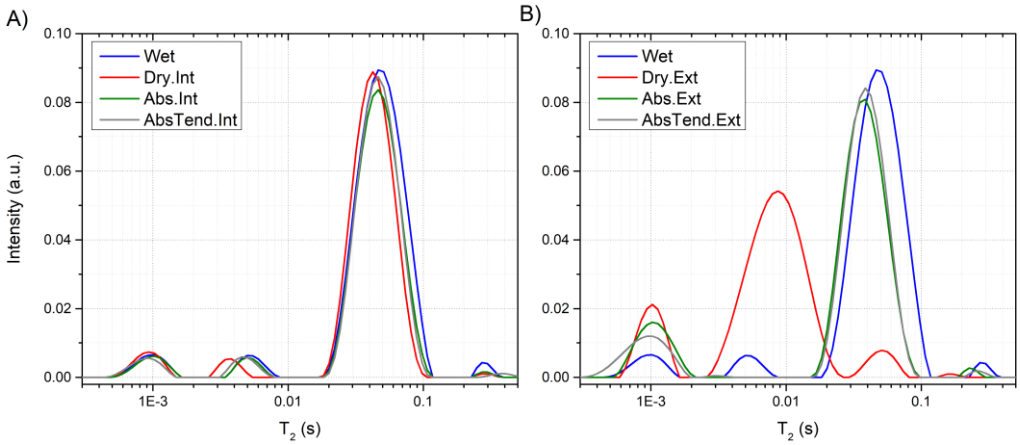

Figure 1. TD-NMR relaxometry data of A) internal parts and B) surface of the meat samples. These T_2 relaxation spectra was obtained by the Inverse Laplace Transform of the average CPMG data signals, using regularization factor a=1 and 100 points.

IV. CONCLUSION

TD-NMR relaxomery can be used to assess meat dry dynamics. The use of absorber can lead to an improvement of water loss, which might maximize the flavor compounds towards to a more flavorful meat, without any trimming and excessive drip losses compared to the dry processing. The tenderization did not improve the drying process.

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